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Chronica Horticulturae

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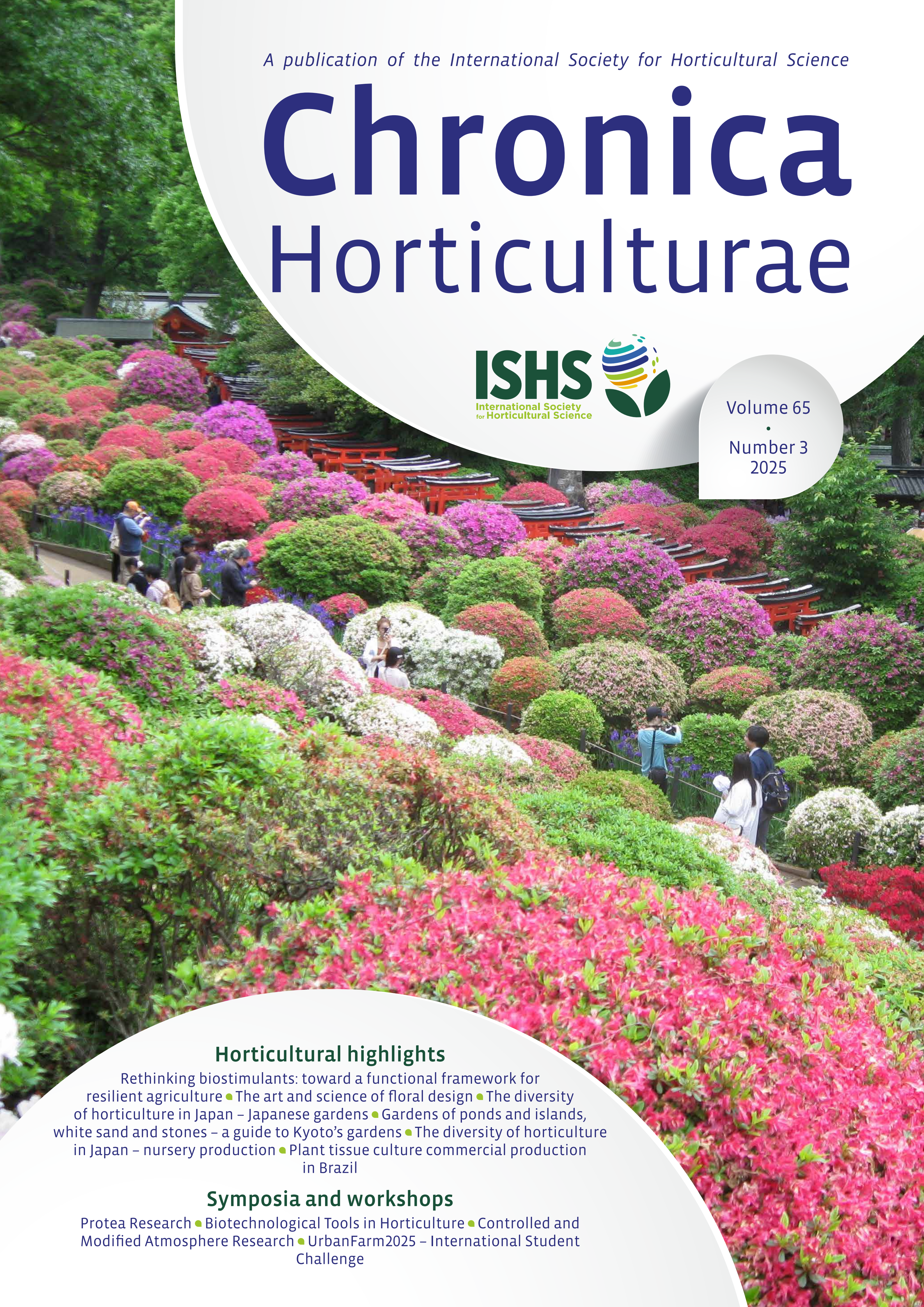

Horticultural highlights

Rethinking biostimulants: toward a functional framework for resilient agriculture • The art and science of floral design • The diversity of horticulture in Japan – Japanese gardens • Gardens of ponds and islands, white sand and stones – a guide to Kyoto's gardens • The diversity of horticulture in Japan – nursery production • Plant tissue culture commercial production in Brazil

Symposia and workshops

Protea Research • Biotechnological Tools in Horticulture • Controlled and Modified Atmosphere Research • UrbanFarm2025 – International Student Challenge

Chronica Horticulturae

A publication of the International Society for Horticultural Science, a society of individuals, organizations, and government agencies devoted to horticultural research, education, industry, and human well-being.

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Scripta Horticulturae is a series from ISHS devoted to specific horticultural issues such as position papers, crop or technology monographs and special workshops or conferences.

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Pubhort is a service of ISHS as part of its mission to promote and to encourage research in all branches of horticulture, and to efficiently transfer knowledge on a global scale. Additional information can be found at **www.pubhort.org**

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Cover photograph: The famous tsutsusi azalea garden in Nezu shrine in Tokyo. See article p.26.

› From the cockpit

Peter J. Batt, Editor, *Chronica Horticulturae*

› Peter J. Batt

To change – to alter or to modify – to replace something with something else. As you clicked on the link to open this latest edition of *Chronica Horticulturae*, did you notice the change to our cover? After many months and multiple iterations, our new logo finally sees the light of day. It brings with it a bold new statement – Advancing horticulture for a better tomorrow together. As the world's largest, independent, non-profit horticultural society, we believe this statement captures who we are, what we do and what we want to achieve.

In this edition, we have four fascinating insights into the world of horticulture. Twelve months out from IHC2026 in Kyoto, Team Japan has been working overtime to promote the event. Takashi Awano provides us with some historical insights into the development of Japanese gardens over the last two millennia. Not unexpectedly, the design of many of the early gardens in Japan was inspired by images from China and Korea. In the mansions of the aristocrats, ponds were constructed in the southern garden area, an island was placed in the pond, a bridge was built over the pond, and water was drawn into the pond through a stream. Whereas Western gardens are based on the idea of conquering nature, Japanese gardens are based on the idea of harmony with nature. A stone waterfall, where water flows from a high place to a low place, resembles nature better than a fountain. Often, the banks of these ponds were decorated with dramatic stone arrangements. In the tea gardens, stepping stones, stone basins and lanterns have become an indispensable element of modern Japanese gardens, while in the Zen gardens, others established dry landscape gardens using stones and white sand.

Tomoki Yamauchi continues to build on these themes, taking us on a guided tour of the historical gardens within Kyoto. As a city of considerable political and cultural importance, the gardens of Kyoto provide examples from every period and style, ranging from ancient to modern in an unbroken continuum. The Ninomaru garden at Nijō Castle and the Sampō-in Garden of Daigo-ji both provide excellent examples of feature ponds with floating islands where the stone retaining walls not only protect the water's edge but are so grand in scale that they constitute the garden's principal scenic feature. Traditionally, while most of these gardens were designed to be viewed from the interior, around 1,000 years ago, the focus shifted towards viewing the pond and the garden from the exterior, where the buildings became an integral part of the overall design. In a dramatic departure from ponds and islands, the Zen gardens of Kyoto are waterless, level gardens, where the soil is covered with white sand upon which stone compositions are set. Yamauchi san invites us to visit the gardens of Daisen-in, Zuihō-in, the Honbō Garden of Tōfuku-ji, the Konchi-in Garden and the Ryōan-ji Temple Garden, where we may contemplate what images the designers sought to portray.

In the third article, Masayoshi Nakayama, Masaki Ochiai, Kazuo Ichimura and Kunio Yamada discuss nursery production in Japan. Within Japan, ornamental trees and shrubs are produced for cut flowers, cut branches, potted plants and for amenity horticulture. Flowering cherries, peaches and apricots, camellias, rhododendrons and azalea all have a long history of cultivation within Japan, where each has become enshrined in Japanese culture and each plays an important role in expressing the seasons. As Japan is so urbanised and apartments are small, potted plants must be compact and of high ornamental value. Long-term cultivation by consumers is seldom expected. Due to the high heat and humidity, the production of bedding plants in the summer months is particularly problematic. Species such as *Vinca* and *Pentas* have proven to be the most suitable for urban planting due to their shade and drought tolerance as well as heat tolerance. Petunia remains the most popular bedding plant for planting from spring to early summer, whereas pansy and primrose are preferred for planting in autumn to spring. Ornamental kale is widely used in winter because of its strong cold tolerance.

Leaving Japan, Patrícia Duarte de Oliveira Paiva, Renato Paiva, Edilson Paiva, Marcos Paiva and Luciano Vilela Paiva discuss the commercial development of in-vitro propagation in Brazil. Despite the higher costs, tissue culture provides a means of propagating high quality plants all year round. While the first commercial tissue culture laboratory focused primarily on orchids, others have sought to produce virus-free strawberry mother plants, potato mini-tubers, papaya, bananas, grapevines, citrus and anthurium. Today, there are nine commercial tissue culture laboratories in Brazil, which collectively produce around 70 million seedlings per year, primarily for the domestic market. Clonal propagation is the most widely used practice, but some companies are utilizing other methods, including callogenesis, in-vitro seed germination, embryogenesis, mutation induction and viral cleaning.

Staying on the topic of plant propagation, among our Young Minds awardees, Anna Gkotzamani examines the effects of carefully timed and combined light regimes on the growth, physiology and quality of vegetable seedlings produced in a plant factory with artificial light. To mitigate the impacts of climate change, Julian Nick Bauer explores how the application of dormancy breaking agents affects the flowering of cherries, while Francisco J. Maldonado González looks at the application of phytohormones to enhance the reliance of cherries to abiotic stress. To reduce the amount of chemicals applied to crops, Thelma Guadalupe Valdez-Reyes looks at the fungicidal activity of an essential oil derived from Mexican oregano to control anthracnose in mangoes, while Honami Nakasuji explores the use of UV-B irradiation to control powdery mildew in roses. As the primary objective of agriculture is to nurture human health, Didiana Gálvez-López looks at the biological and nutritional attributes of native mangoes in Mexico. In a similar study, Sara Parralejo-Sanz explores the immunomodulatory potential of different *Opuntia* cactus species. Working also with *Opuntia*, Giuseppe Greco looks at how plant age impacts the ability of the plant to enhance soil organic carbon in Mediterranean drylands. Finally, Daniela Ramos explores how pre- and postharvest factors influence internal browning in apples.

Finally, James DelPrince, Alessandro Lanteri and Margherita Beruto provide us with some valuable insights into the global market for cut flowers and ornamental plants. While ornamental plants are primarily purchased for their decorative attributes, we should not overlook the contribution that they make to our quality of life. Numerous studies have demonstrated the positive effects of ornamental plants in reducing stress, anxiety and depression. Furthermore, ornamental plants improve air quality, mitigate the impacts of high temperature in urban environments, reduce soil erosion and provide habitats for wildlife. While consumers today have become more price sensitive, it is possible to increase the monetary value through appropriate floral design. This paper explores how, through floral design education, it is possible to influence consumers' feelings toward flowers and how they sense them.

› The new look of ISHS

François Laurens, ISHS President
Peter J. Batt, ISHS Board member in charge of communications and ESG

› François Laurens

› Peter J. Batt

After months of careful planning and deliberation, we're delighted to announce the launch of the new ISHS website and logo. Both are accompanied by the launch of a new online newsletter and an enhanced presence on social media through LinkedIn.
The need to develop a new website was brought about by the need to move from our existing platform (Drupal), which will not be supported beyond 2026, to the vastly superior WordPress. We also took the opportunity to revise and improve its functionality. The new website will operate under nine key headings: About us; Symposia; Publications; Media; Advocacy; Membership; Young Minds; News; and a new Members Only portal. The ISHS calendar of events can be found under Symposia. Publications include *Acta Horti-culturae*, *Chronica Horticulturae* and *Scripta Horticulturae*. The *European Journal of Horti-cultural Science* (eJHS), the official journal of ISHS, is now published by CABI and all current issues, as well as back issues of eJHS and *Fruits, The International Journal of Tropical and Subtropical Horticulture,* can be found on the publisher's website. For the Young Minds, we will offer a dedicated webpage where relevant news can be uploaded and members will be able to access some of the new services we offer to our Young Minds as these become available.
As the world's largest, independent, non-profit horticultural society, where our members are among the most prominent scientists in their field, we believe that ISHS has a unique role to play in providing advice and commentary on the key issues impacting our planet: climate change, resource use efficiency, sustainability, biotechnology, AI, and the role of horticulture in enhancing the quality of human lives and livelihoods. These pages will be populated in time as we commission work on these topics and others.
In developing our new logo, we wanted something that was modern, colourful and dynamic and would appropriately capture our vision of being a global horticultural society. Our new logo comes with a new headline statement: Advancing horticulture for a better tomorrow together. We believe this statement captures who we are, what we do and what we want to achieve. While the new logo appears now on the website, *Chronica Horticulturae* and eJHS, in the weeks ahead it will make its way onto all new editions of *Acta Horticulturae* and all our promotional tools.
By the time you read this, many of you will have already received our first new email newsletter. Coming out on a monthly basis, or thereabouts, the newsletter will provide you with immediate updates on symposia and other key events, the publication of papers in eJHS, *Acta Horticulturae* and *Chronica Horticulturae*. With the publication of this newsletter, *Chronica Horticulturae* will be repositioned as a members-only publication.
Similarly, for those of you who rely on social media for your news rather than email, the new LinkedIn app will provide you with similar information. However, as LinkedIn is more interactive, it will also provide you with an opportunity to post your comments.
Stay tuned, change is coming, let us know what you think.

ISHS
Advancing horticulture
for a better tomorrow together

› Growing benefits to grow our membership

Lukas Bertschinger, ISHS Board member in charge to strengthen membership and outreach

› Lukas Bertschinger

ISHS membership categories

Making ISHS more attractive for horticulturists of all ages is important to assure the future of our Society. With this in mind, the ISHS Board has introduced three new membership categories: Professional; Student and Early Career; and Retired.

Professional membership is ideal for scientists, horticulturists, extensionists, and industry experts. This membership category connects you to the global horticulture community, enabling you to expand your network, share your research outputs through renowned ISHS publications, and gain visibility at international symposia and congresses. Professional members also have an opportunity to directly engage in the activities of ISHS, by convening symposia, initiating or leading Working Groups, or chairing Divisions.

Student and Early-Career membership is targeted at undergraduate or graduate students under the age of 28 years, or early-career professionals, a post-doc for example or a recent graduate, with less than 10 years of experience and under the age of 40 years. As the future of our Society is very much dependent on recruiting young professionals, ISHS aims to provide a variety of support mechanisms, including a mentoring platform and career-building programs. Through the ISHS Young Minds Awards, we recognize the contribution students and early-career professionals make to our symposia by providing awards for the best oral and poster presentation by a student or early-career professional.

Retired membership provides an opportunity for our older statesmen and women to stay engaged and to make a lasting impact. As a retired professional, ISHS will provide opportunities for you to share your expertise through mentoring, contribute to publications, and stay connected with colleagues worldwide.

ISHS membership benefits

The most common way people have joined ISHS is when preparing to participate in one of our many international symposia. However, even without attending an ISHS symposium, there are many outstanding membership benefits that make ISHS membership worthwhile and rewarding, including:

- 20 free article downloads per year from the vast collection of *Acta Horticulturae*;
- publishing in *Acta Horticulturae* at no cost, and exceptional publishing opportunities in the relaunched *European Journal of Horticultural Science* (eJHS), with a reduced article processing charge;
- access to the global ISHS network through our membership directory offering an unparalleled resource for collaboration and innovation.

An overview of all ISHS membership benefits can be found at www.ishs.org/ishs-membership-benefits

ISHS membership discounts

To accommodate the different membership categories, ISHS offers attractive membership fees with reduced rates for students, early-career, and retired professionals. We are also offering discounts of 5% when members renew their membership before it expires and a 10% discount for multi-year membership.

Members from low-income or lower-middle-income countries continue to benefit a discounted membership fee.

Your opportunity to recruit a new ISHS member

Traditionally, individual ISHS membership numbers have been high in Europe, North America and Oceania. While we seek to both sustain and indeed expand membership from these regions, it is also our desire to seek greater participation from Africa, Latin America and Asia. Here we hope that you, our members, as ISHS Ambassadors, and in view of the growing benefits of an ISHS membership, will each make an effort to recruit new members whenever the opportunity presents itself. In the coming months, the ISHS Board will introduce a number of new initiatives to attract more members from the developing world.

With the launch of the new website, **www.ishs.org**, I encourage you to explore the new membership categories and convince your colleagues and fellow researchers to join the ISHS or to re-activate their ISHS membership!

Join ISHS today and help us to advance horticulture for a better tomorrow together.

ISHS membership PRO JOIN NOW! | ISHS membership YOUNG MINDS JOIN NOW! | ISHS membership RETIRED JOIN NOW!

› Check all membership categories and discounts at
www.ishs.org/ishs-membership-categories

› Check all membership benefits at
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Issues

Rethinking biostimulants: toward a functional framework for resilient agriculture

Petronia Carillo, Patrick H. Brown, Theodore M. DeJong, Patrick du Jardin, Fabricio Cassán, Antonio Ferrante, Vasileios Fotopoulos and George Manganaris

The ISHS HortForum Episode 7: "Plant Biostimulants: (How) Do They Work?", held in March 2025, brought together more than a thousand participants to explore a central question in contemporary agronomy: how to define, evaluate and apply biostimulants as part of resilient and sustainable crop systems. The discussion was framed by a keynote presentation from Patrick du Jardin from the University of Liège (Belgium), which offered a structured reflection on how biostimulants have evolved from poorly characterized formulations to functionally defined tools. This keynote presentation set the stage for a wide-ranging scientific exchange that moved beyond regulatory terminology to focus on physiological relevance and agronomic integration.

A panel of distinguished experts further enriched the event, bringing diverse perspectives to the discussion. Panelists included:

- Prof. Vasileios Fotopoulos from Cyprus University of Technology (Cyprus);
- Prof. Patrick H. Brown from UC Davis (USA);
- Prof. Petronia Carillo from the University of Campania Luigi Vanvitelli (Italy);
- Prof. Fabricio Cassán from Universidad Nacional de Río Cuarto (Argentina);
- Prof. Antonio Ferrante from the Sant'Anna School of Advanced Studies (Italy).

Their insights spanned plant molecular biology, plant physiology and biochemistry, microbiology, agronomic applications and regulatory considerations, offering a comprehensive view of the challenges and opportunities within the biostimulant sector.

What emerged was a significant shift in perspective. Biostimulants are increasingly understood not in terms of what they contain, but in terms of what they do. Their effects on nutrient uptake, root development, stress adaptation and overall physiological balance are not always visible in yield alone. Yet, they are critical in stabilizing plant function under variable conditions. Rather than promoting growth, biostimulants enhance the plant's ability to respond to challenges such as abiotic stress. This reframing, from composition to function, from inputs to processes, reflects a broader move towards agronomy that prioritizes biological efficiency and long-term resilience.

Current regulatory frameworks have begun to reflect the evolving understanding of biostimulants, recognizing their role in promoting plant nutrition, enhancing stress tolerance and improving overall performance without acting as traditional fertilizers or pesticides. However, important inconsistencies remain across countries and regions, especially regarding microbial products and complex formulations that work through multiple mechanisms. In many cases, these products do not fall easily into a single category. Some microbial strains improve nutrient availability, others help plants respond to stress, and many do both simultaneously. Yet, depending on the country, the same product type might be regulated as an inoculant, a biopesticide, or a biostimulant, even if the effect on the plant is similar. This inconsistency is especially problematic for modern biostimulants that combine microbes, organic compounds and physical carriers to produce synergistic effects. These products often do not fall into a single predefined category and are difficult to assess using traditional, single-target validation protocols. They may promote nutrient uptake, modulate stress responses, or enhance physiological efficiency, without supplying nutrients in the classical sense. As biostimulant technologies continue to evolve, the gap between how they work and how they are regulated is widening. Relying on composition-based definitions is no longer sufficient. Regulatory frameworks need to evolve toward a function-oriented approach that reflects scientific progress and supports responsible innovation. This means assessing how products act in plants and what measurable outcomes they deliver, rather than focusing only on their ingredients or conventional categories. Importantly, such a shift should not be seen as a relaxation of standards or as permission to market products with undefined mechanisms. On the contrary, it creates the opportunity to expand the functional scope of biostimulants, while also reinforcing the incentive to identify and validate the mechanisms involved. A more flexible framework, built on mechanisms and validated effects, would not only improve transparency but also facilitate research and keep regulation aligned with agronomic practice.

Field research and experimental evidence presented during the HortForum made it clear that yield alone is not a reliable measure of biostimulant effectiveness. While crop productivity remains a central agronomic goal, biostimulants are not designed to boost biomass directly, and their true value often lies elsewhere. These products typically enhance physiological stability and reduce the degree to which plants are affected by stress, especially under suboptimal environmental conditions. They help maintain water balance, protect cellular structures from oxidative damage, and support root activity during heat, drought or nutrient limitation. These effects can be crucial for maintaining crop quality and preventing losses, even if the final yield remains unchanged. However, such outcomes are difficult to detect using conventional agronomic metrics. Trials based only on biomass accumulation or harvest weight may overlook key benefits such as improved water use efficiency, stronger antioxidant systems, or deeper root systems that allow better nutrient access. These physiological advantages may not produce immediate visual differences, but strengthen plant performance over time, particularly under stress.

A broader and more targeted set of indicators is needed to evaluate biostimulants properly. This includes physiological measurements like stomatal conductance, chlorophyll fluorescence, osmotic adjustment, or the activity of stress-related enzymes, as well as molecular and metabolic profiles that reflect changes in plant responses. Monitoring these parameters can reveal how biostimulants influence the plant's internal regulation and help link product action to functional outcomes. A more comprehensive evaluation framework, grounded in plant biology rather than just productivity, would allow researchers and growers to understand better when, how and why biostimulants deliver real agronomic value.

Timing is also crucial when it comes to the effective use of biostimulants. Biostimulants are most effective when applied before key developmental stages or predicted stress events, such as flowering, fruit set or drought. This proactive approach helps prepare the plant's physiological systems, reducing vulnerability and supporting essential functions during stress. This requires understanding crop phenology, environmental risks and local conditions, as biostimulants are not one-size-fits-all solutions, but need to be integrated into context-specific programs. Their mode of action, based on modulating plant responses and priming stress-related pathways, depends not just on product formulation but also on correct timing and agronomic management. This perspective reflects a more advanced view of plant health as a dynamic, adaptive capacity that can be reinforced through biological support. In this context, biostimulants are comparable to functional foods in human health. Biostimulants are applied not to push the plant beyond its limits, but to maintain internal equilibrium and prepare it for variability. This transition supports a new agronomic paradigm based on care, resilience and biological insight. It requires a new way of thinking, where agriculture is managed not as a controlled process, but as a living system. In this system, biostimulants enhance the plant's adaptive capacity, support efficient resource use and reinforce long-term functionality.

Advances in formulation technologies, including smart carriers, biopolymer matrices and nanomaterials, further challenge conventional validation protocols, which are typically designed for single-compound products with clearly isolated effects. The biological complexity of biostimulant action requires a new regulatory logic based on functional outcomes, not compositional simplicity. Evaluation should consider how multiple components interact within the plant-soil-microbiome system to produce measurable and reproducible benefits. This complexity does not undermine the credibility of biostimulants, but instead calls for a new validation standard that links biological mechanisms to agronomic targets and real-world results, ensuring that products are assessed based on their true, integrated impact.

Commercial communication must also evolve. Oversimplified claims about yield enhancement can mislead users, obscuring these products' broader and more meaningful contributions to plant health. By focusing narrowly on potential biomass increases, such claims create unrealistic expectations, which, when unmet, undermine trust in biostimulants. To build and maintain this trust, it is essential to provide clear, transparent explanations of how these products work, including the conditions under which they are most effective. This communication should emphasize the mechanisms behind their action and the factors that influence their success, ensuring that growers understand not only the potential benefits but also the limitations. Moreover, innovation should focus on solid agronomic principles, rather than short-lived market trends or regulatory gaps. Providing clear, evidence-based communication rather than market-driven claims will ensure biostimulants are responsibly and effectively integrated into sustainable farming systems.

A key outcome of the HortForum was the recognition that biostimulants are not stand-alone solutions, but must be integrated into broader agronomic management, evidence-based strategies for crop care. Their role is clearest when combined with precision fertilization, targeted irrigation and microbiome management. As agriculture moves away from input intensity toward ecological efficiency, biostimulants can help reduce chemical dependency and promote stability without sacrificing productivity.

The key directions that emerged from the HortForum reflect this transformation. They include reframing biostimulants around physiological function, expanding success metrics beyond yield, aligning validation with mechanisms of action, integrating products into whole-farm strategies, updating regulation to account for complexity, promoting preventive rather than reactive applications, ensuring credible communication, advancing biologically grounded innovation, and embracing an agronomy built on care rather than control. These priorities define the path forward for biostimulants – not as marginal technologies – but as vital tools in the transition to sustainable agriculture.

The successful orchestration of this webinar was made possible by the dedicated efforts of the organizers:

- Prof. Theodore M. DeJong from UC Davis (USA);
- Prof. George Manganaris from Cyprus University of Technology (Cyprus).

Their commitment to fostering international collaboration and knowledge exchange was evident in the seamless execution of the HortForum.

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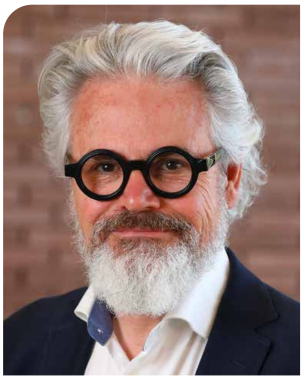

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The art and science of floral design

James DelPrince, Alessandro Lanteri and Margherita Beruto

The floriculture industry is a very diverse and dynamic sector that includes all those businesses and activities related to producing, shipping and selling flowers, cut ornamental foliage, and potted ornamental plants. Many products are managed along the value chain, which involves many alternative market channels and multiple professionals, including breeders, nurseries, growers, wholesalers and retailers, and suppliers of decorative materials.

In 2024, the International Association of Horticultural Producers (AIPH), in collaboration with Union Fleurs (the International Flower Trade Association) valued the ornamental horticulture industry at EUR 65 billion (AIPH, 2024). Europe is a large producer, trader and consumer of ornamentals with more than 500,000 employees engaged in the different levels of the value chain: producers (47%), wholesalers (10%), and the retail sector (43%). The cut flower market is vibrant and has a significant impact worldwide, with a total value of about EUR 20 billion per annum. The value chain acts globally, integrating many interdependent actors in both the southern and northern hemispheres. Developing countries in Africa (Kenya and Ethiopia) and South America (Colombia and Ecuador) have become significant suppliers of cut flowers. While Europe imports flowers primarily from Africa, South American producers supply the USA through Miami and European producers through New York. The Netherlands is an important hub both for the European market and global trade, distributing ornamentals throughout Europe, Canada, China, Japan, and the USA.

While ornamental plants are usually purchased for their decorative attributes, we must highlight the contribution they make to an improved quality of life. Numerous studies have demonstrated the positive effects of ornamental plants in reducing stress, anxiety and depression. Moreover, ornamental plants contribute to environmental sustainability by improving air quality, reducing soil erosion and providing habitats for wildlife. They are crucial in mitigating heat island effects and enhancing urban biodiversity. However, geopolitical tensions, climate change and variable consumer preferences create seasonal fluctuations and economic downturns, impacting sales and profitability.

Innovation in product offerings and marketing strategies present opportunities for growth and resilience. Sustainable cultivation methods, reducing the use of chemicals and pesticides, and encouraging the more widespread use of native plant species, provide eco-friendly opportunities for both producers and consumers.

Technological advancements are transforming the ornamental industry. Innovations in plant breeding, automation for irrigation and pest and disease control are proving to be more profitable and sustainable for producers. Digital marketing and e-commerce are expanding the market and making it more efficient.

The consumption of flowers and ornamental plants

The consumption of cut flowers and ornamental plants expanded considerably between 2020 and 2021, largely due to the global pandemic. Evidence suggests, however, that ornamental plants continue to be important (Löbke, 2022). At a global level, the consumption of cut flowers is concentrated in Europe, the USA and Japan, which collectively account

› For Carnevale's international revelers, fresh, Ligurian-grown flowers (*Anemone*, *Matthiola*) and ornamental foliage (*Ruscus*) grace the tables at La Fenice Opera House, Venice, Italy (Image by James DelPrince).

for about 75% of total flower consumption. Van Horen (2017) estimated that by 2027, Europe and North America could increase their consumption by 20%, while consumption in Asia could increase by 60-80%.

The consumption of cut flowers and ornamental plants depends on several factors, including the consumers' demographics, lifestyle, how consumers intend to use the floricultural products and how often they buy (Fratello et al., 2022). For instance, the "baby boom" generation (now 57 to 75 years old) has expendable income and prefers to shop in person with high expectations of customer service. The "sandwich" generation (people aged 41 to 56) are looking for quality and convenience, but they also require good customer service and frequently use social media. People aged 25 to 40 are the "millennial" generation, where the internet and social media dominate their lives. They integrate in-store shopping as a social event with online purchasing. This generation appreciates eco-friendly approaches and uses flowers for their personal well-being. Sheth et al. (1991) proposed five values that encourage people to buy flowers: the *functional value* is defined by the physical attributes of flowers (e.g., range of colors and vase life); *social value* is derived when people purchase flowers (e.g., an expensive bunch of peonies or tulips out of season) to emphasize their social status; *emotional value* is found when flowers stimulate consumers' emotions and feelings (e.g., a floral bouquet given on a date); *conditional value* is associated with purchasing flowers for some specific occasion (e.g., a poinsettia at Christmas time); and *epistemic value* is based on the capacity to create curiosity, to provide novelty and satisfy a desire for knowledge (e.g., exotic plants in European countries, new products or local crops).

Retail florists need product value awareness because many consumers undervalue floral products. Knuth et al. (2023) found that consumers generally assign lower price points to flowers and plants than what the product is truly worth. They concluded that consumer education and floral product marketing were key to product appeal and purchase. However, these efforts can be difficult to manage because florists are already challenged to provide high-quality products and services. Gabellini and Scaramuzzi (2022) summarize the consumer demand for flowers and ornamental plants according to the following descriptions: quality over price, sustainability and transparency, flowers and plants for therapeutic and social value, locally grown and seasonal materials, and services such as product selection and advice.

Floral design

Consumers use flowers to communicate messages that are often difficult to put into words. Floral arrangements can reflect human emotions and are commonly used to express sympathy, elation, sorrow, congratulations, and well-wishes (Hunter, 2012; Johnson et al., 2001; Scace and DelPrince, 2023).

› A florist's ready-made handtied bouquet illustrates the potential for *functional, social, emotional, conditional,* and *epistemic values*. It features *Chamelaucium, Chrysanthemum, Gerbera* (Gerrondo), *Lepidium, Limonium* varieties, and *Matthiola*. Bruges, Belgium (Image by James DelPrince).

When making a floral purchase, consumers are interested in the elements of floral design (color, texture, fragrance, pattern, etc.). They value the monetary worth and sensory hedonics, their feelings toward flowers, and how they sense them (Yeh and Huang, 2009). Many of them value floral longevity (Rihn et al., 2014).

Floral designs can be classical or trendy and take cues from traditions and trends. Flowers frame an event and make it more special by their presence. Floral designs at events confer to attendees the importance of the event, affluence, and the style and taste of the host. Today's floral consumers rely upon the massive amount of data and imagery available on social media to learn about and communicate floral design preferences to others. Park and Oh (2019) found that 90% of consumers preferred searches on their mobile devices rather than personal computers, using them to learn more about flowers through social networking services such as Instagram, Facebook and Pinterest.

Consumers follow trends from sources such as the Flower Council of Holland (2024). The Council's four horticulture trends for 2025 – slow life, unique utopia, cosmic future and radiant energy – reflect a collective desire for optimism and reconnection. These trends reflect personal insights for well-being and taking time to reflect in uncertain times.

The International Fresh Produce Association (2024) notes that consumers are becoming more frugal and conscious about how they spend their money. They may be attracted to floral purchases through perceived discounts, combining affordability with value. Retailers can capture shoppers with more economical choices, offering products around 10% lower than the average price per category. Where a 75 EUR arrangement is the average, a menu selection offering a 68 EUR option may be enough to attract potential buyers seeking product quality and value at an affordable price.

Fashion trends demonstrate that Italian brides are opting for commanding floral arrangements, including Tuscan-inspired arrangements fusing rustic containers with metallic accents and olive branches (Elegantize, 2025). However, despite technological advances, many brides opt for traditional flowers and colors, especially in southern USA. For decades, brides have dreamed of wedding ceremonies on southern plantations, using large-scale architecture and carefully maintained, formal landscapes as a nuptial background. However, the 21st-century social justice movement cast things in a different light, with many reconsidering whether a southern wedding and such a background and its associated trappings (fashion, hairstyles, and floral arrangements) were still appropriate (Holmes, 2022). Nevertheless, the floral designs related to the USA southern wedding are still highly sought after, using an abundance of cut flowers for altar designs and flowers-to-carry. Jet transportation and commercial flower forcing technology have enabled the use of out-of-season flowers, and depending on the wedding budget, layers upon layers of premium cut flowers from multiple sources are utilized in massive arrangements.

A great deal is at stake in the messages, connotations and promoting the value of flowers, as consumers of floral products want to make suitable investments and expect (demand) a long vase life. There is a need for floral consumer education in postharvest care and handling, technical floristry and design principles.

Based on research findings and marketing models, an informed consumer is more likely to make a floral purchase. Therefore, floral design education is important, not only to demonstrate the added value that professional florists are able to contribute, but also for floral product consumers to assist them in how to better arrange the flowers they have purchased within their home. Many adult learners desire knowledge for knowledge's sake and the social interaction derived from interacting with like-minded people (Green, 2002).

A variety of privately owned professional floristry training schools and floral design workshops can be found throughout Europe. Examples of such schools include European Floral Design Education (EFDE, 2025), Belgium; European Master Certification (EMC), Belgium (https://www.europeanmastercertification.com/); Gregor Lersch, Germany (https://gregorlersch.de/); and Rudy Casati, Italy (https://www.rudycasati.it/rudy/). These schools and others offer basic and advanced training programs for floral designers and do not distinguish between programs for consumers and professionals. After completing such programs, participants can gain jobs in retail florist shops, studios and other floral enterprises. Some florists desire to attain higher levels of distinction. In France, education and practice can lead to the prestigious award "Meilleur Ouvier de France," where the government recognizes candidates for distinction within a specific category of expertise (i.e., hospitality, architecture, fashion, interior design, and horticulture) (MOF, 2025).

In the USA, the Mississippi State University (MSU) Extension has developed a floral design training program for adults 18 and above specifically for consumers of floral products who do not seek to make profits from their work. This consumer-level floral design program teaches participants about postharvest care and handling of cut flowers, design principles, and elements. It offers floral design demonstrations and hands-on training in three separate phases. Phase I is a 14-unit, 100% online course consisting of 14 hours of content. The course features units on floral design topics and a pre-/post-test to measure learning outcomes. Students must complete the tests and a course evaluation to advance to Phase II. The second phase involves a four-day, 32-hour, in-person workshop at the MSU Coastal Research and Extension Center, Biloxi floral design studio. The studio has two refrigerators, a full range of floral supplies, and AV equipment. Participants are provided with high-quality floral tools, cut flowers, containers and supplies, and they complete 13 projects. In the last phase of the training, students complete 40 volunteer hours to promote non-profit floral design excellence in the program's final phase. Their volunteer projects include but are not limited to teaching floral design projects to others, initiating/participating in floral designing for houses of worship, and assisting extension with floral design teaching, research and outreach. Since its inception, 116 people from 10 states (Alabama, Florida, Illinois, Louisiana, Kansas, Mississippi, North Carolina, South Carolina, Tennessee, and Washington) have participated in the program.

Master Floral Designers are informed consumers of floriculture products. Participants are requested to report on their volunteer activities and spending each year. In 2022-24, 67 reports detailed purchases of over 37,295 EUR (40,300 USD) of cut flowers and related floral supplies. Their average annual purchases increased from 404 EUR (437 USD) in 2022 to 753 EUR (814 USD) in 2024. According to the latest Society of American Florists (2025) data, the average consumer spends just over 157 EUR (170 USD) annually on flowers, seeds and potted plants combined.

Floral consumers are willing to make purchases if they know what they are buying and how to use it. Indeed, education builds the need for more education. As floral designers, whether amateur or professional, building knowledge and skill, they increase their affinity for continuing education. Chu et al. (2018) found that when students completed floral design classes, they increased their attitudes and persistence in education. This is important to build the profession because trainees can become more specialized and better able to meet customer demand, thereby creating higher levels of consumer satisfaction. Industry members can partner to initiate and keep a floral design program in place. For example, the University of Nebraska's horticulture department has found success with industry teachers leading floral design classes under faculty supervision (Paparozzi and Lambe, 1994). MSU faculty members have found that floral design courses using specific types of materials can stimulate consumer interest in sourcing and purchasing those materials (DelPrince and Knight, 2024). High student success rates can be found whether students complete floral design courses online or in person (Etheredge and Waliczek, 2021). MSU Extension has added the Advanced Master Floral Designer certificate to its educational lineup this year. The course content includes Asian and European theory, design practice, and bridal, event, and commemorative floral design.

By enhancing aesthetic appeal and promoting well-being, cut flowers contribute to the quality of life and cultural richness. Economically, the industry provides substantial employment opportunities and generates significant revenue, as its products and services are valued among consumers.

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Courses and meetings

The following are non-ISHS events. Be sure to check out the Calendar of ISHS Events for an extensive listing of all ISHS meetings. For updated information, log on to www.ishs.org/calendar

Webinar on Transforming horticulture: FAO Smart Farming Initiative in action, 30 September 2025. Registration link: https://fao.zoom.us/webinar/register/WN_89DbZdWZQaOWIBwbLbDvug#/registration

Technical Course on Biostimulants: Mechanisms of Action, Trial Protocols and New Technologies, 7-28 November 2025. Info: Marta Guarise, Training & Projects Manager Agricola 2000, Phone: +39 02 906 311 86, E-mail: m.guarise@agricola2000.com, Web: https://www.agricola2000.com/biostimulants-mechanisms-of-action-trial-protocols-and-new-technologies/?lang=en

ISHS Young Minds Award winner summaries

Below is a selection of research summaries from winners of ISHS Young Minds Awards for best oral and poster presentations at ISHS symposia. To view other exciting research summaries by other winners, please visit www.ishs.org/young-minds-award

Opuntia ficus-indica chronosequence affects soil carbon mineralization rates

› Giuseppe Greco

As part of my doctoral dissertation, this study sought to investigate how the age of *Opuntia ficus-indica* orchards affected soil organic carbon (SOC) mineralization in Mediterranean drylands. The work was conducted in Sicily (Italy), where cactus pear is not only a resilient crop, but also a key component of local agro-ecosystems. The study focused on two contrasting soil textures: loamy-clay and sandy-loam, across a chronosequence of *Opuntia ficus-indica* orchards aged 1 to 30 years.

Using a chronosequence approach, soil samples were collected from three depths (0-15, 15-30, and 30-60 cm). Laboratory incubations were performed to measure carbon mineralization rates (CMIN), expressed as CO_2-C release. The results showed that mineralization significantly increased with orchard age, particularly in surface soils. In older orchards, the highest microbial activity and carbon turnover was observed, indicating an accumulation of labile carbon over time. Interestingly, the clay-rich soils promoted deeper carbon cycling, while the sandy soils showed earlier stratification in the top layers.

The research results demonstrate how long-term cactus pear cultivation can enhance SOC dynamics, supporting microbial processes and improving soil quality under water-limited conditions. The data suggest that *O. ficus-indica* functions not only as a low-input crop for food and forage, but also as a biological tool for regenerating degraded soils and mitigating climate change through enhanced carbon cycling. This work shows that it is possible to produce food while simultaneously building soil life and restoring degraded landscapes.

This project would not have been possible without the invaluable guidance of Professor José Carlos Batista Dubeux Jr., Professor Paolo Inglese, and Professor Giorgia Liguori.

Giuseppe Greco won the ISHS Young Minds Award for the best oral presentation at the XI International Congress on Cacti as Food, Fodder and Other Uses in Tenerife, Spain, in May 2025.

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Immunomodulatory potential of *Opuntia* fruits green extracts

› Sara Parralejo-Sanz

In this study we assessed the immunomodulatory potential of different *Opuntia* cactus fruit species, which are rich in betalains and phenolic compounds. Three varieties were analyzed: *Opuntia stricta* var. *dillenii* (OD), *Opuntia ficus-indica* var. *blanca* (BB), and *Opuntia ficus-indica* var. *colorada* (COL), focusing on whole fruit (OD), peel (BB), and pulp (COL). All extracts demonstrated significant antioxidant activity in Caco-2 and HepG2 cell lines and stimulated phagocytosis in RAW 264.7 macrophages.

OD extract exhibited the most diverse phytochemical profile and the strongest immunomodulatory effects, significantly reducing nitric oxide production and enhancing phagocytic activity in macrophages. To determine whether these effects were attributable to specific compound groups or to the synergistic action of the whole extract, OD was fractionated using fast centrifugal partition chromatography (FCPC), obtaining 12 distinct fractions (F1-F12). To further elucidate their immunomodulatory potential, each fraction was evaluated for its influence on the production of key cytokines, including TNF-α, IL-6, IL-1β, and IL-10.

Fractions rich in betalains (such as betanin, neobetanin and isobetanin), piscidic acid, and flavonoid glycosides (quercetin and isorhamnetin) showed distinct anti-inflammatory or immune-activating properties, depending on their composition. For example, F5 significantly inhibited nitric oxide production, F6 reduced TNF-α levels, and F3 and F7 notably reduced IL-1β and IL-6 levels, respectively. Moreover, all fractions and the full OD extract stimulated the production of IL-10, a key anti-inflammatory cytokine.

The findings suggest that both OD whole extract and specific fractions possess strong potential as natural immunomodulators. The synergistic action of the complex compound matrix in whole extracts appears to offer broader benefits, while fractionation enables the identification of individual compounds responsible for specific immune responses. Overall, this research highlights the value of *Opuntia* cactus fruit as a rich source of bioactive compounds with promising applications in immune health.

Sara Parralejo-Sanz won the ISHS Young Minds Award for the best poster presentation at the XI International Congress on Cacti as Food, Fodder and Other Uses in Tenerife, Spain, in May 2025.

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Relation between the amount of pyrimidine dimer generated in *Podosphaera pannosa* and the effect of disease suppression by night-time UV-B irradiation

› Honami Nakasuji

In this study, we focused on UV-B irradiation (280-320 nm) as a novel disease control method as an alternative to synthetic fungicides. Previous studies have reported that UV-B irradiation is effective in controlling powdery mildew (*Podosphaera pannosa*) in roses. To optimize the irradiation method to treat rose powdery mildew, we cultivated roses using UV-B irradiation in greenhouses. At low levels of UV-B irradiation, powdery mildew was suppressed, but at high irradiation intensity, rose leaves were damaged. UV-B irradiation induces DNA damage, leading to the formation of cyclobutane pyrimidine dimers (CPD). These lesions act as an obstacle for the progression of DNA replication and transcription processes. The major pathways to remove CPD from the genome are nucleotide excision repair and DNA repair by photolyase in the presence of light. We examined the optimal UV-B irradiation treatment for controlling rose powdery mildew by investigating the amount of CPD formation through UV-B irradiation at different irradiation times and time periods.

When irradiated for different time lengths (from 0-3.5 h), CPD level increased gradually according to the duration of irradiation. Night-time irradiation resulted in more than twice as much CPD formation as in the non-irradiated control. In daily irradiation for 1 h during the dark period, there was a significant increase in CPD formation after 7 and 14 days. CPD levels under dark periods exceeded the repair of CPDs under light and dark conditions, resulting in CPD accumulation under daily UV-B irradiation. To investigate dark repair of CPDs, we irradiated leaves infected with *Podosphaera pannosa* for 1 h during the dark period and incubated them for 0-5 h in the dark. CPD formation increased immediately after irradiation and then slowly decreased in the dark period, suggesting that dark repair was taking place in *Podosphaera pannosa*. This study will continue to optimize irradiation methods to control *Podosphaera pannosa* in rose cultivation.

Honami Nakasuji won the ISHS Young Minds Award for the best poster presentation at the IX International Symposium on Rose Research and Cultivation in China in May 2025.

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Investigating internal browning in 'Cripps Pink': preharvest climate, ripening rate, canopy position and dynamic controlled atmosphere storage

› Daniela Ramos

Daniela Ramos is an MSc(Agric) student at the Department of Horticultural Science, Stellenbosch University, South Africa, under the supervision of Dr. Elke Crouch. Her research focuses on assessing pre- and postharvest factors influencing internal browning development in 'Cripps Pink' apples. She is collaborating on this project with Dr. Mariana Jooste from HortgroScience as well as Heleen Tayler and Dr. Ian Crouch from ExperiCo (AgriResearch Solutions). Her study investigates the connection between climate-driven physiological fruit development and the effect of canopy position on the postharvest storage performance and maturity of 'Cripps Pink' apples. Climate and orchard data have been collected across 90 orchards and four seasons (2021/2022 - 2024/2025). Maturity indexing data was collected four to six weeks before the optimum harvest date. After harvest, fruit were stored for 9 months in CA storage (1.5 kPa O_2; 0.5 kPa CO_2) at -0.5°C followed by six weeks regular atmosphere storage (RA) at -0.5°C and a simulated 7-day shelf-life at 20°C. Thereafter fruit quality was assessed. The results of the study have shown that inside canopy fruit generally had a higher incidence of internal browning irrespective of the maturity at harvest after long-term storage.

To minimise the incidence of internal browning and postharvest losses, Daniela is also studying dynamic controlled atmosphere chlorophyll fluorescence (DCA-CF) as an alternative to controlled atmosphere (CA) storage. These storage methods were compared across three seasons (2021/2022 - 2023/2024) and multiple farms to determine if DCA-CF (O_2 ≈0.4 kPa; CO_2 <0.5 kPa) was able to retain fruit quality better than CA storage (1.5 kPa O_2; 0.5 kPa CO_2). Initial results demonstrate that post-optimum harvested fruit should not be stored under low oxygen for extended storage periods. However, storing fruit under DCA-CF generally resulted in a reduced incidence of internal browning and better retention of specific fruit quality parameters.

Daniela Ramos won the ISHS Young Minds Award for the best oral presentation at the XIV International Controlled and Modified Atmosphere Research Conference in USA in May 2025.

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PAL and *CHS* gene expression in mango native from Soconusco, Chiapas, Mexico

› Didiana Gálvez-López

Didiana Gálvez-López is a young professor in the Bioscience Institute, in the Autonomous University of Chiapas, Mexico. Didiana's research is focused on identifying biological and nutritional attributes of native mango germplasm from southern Mexico using strategies such as genetics, biochemical and physicochemical methods, for future breeding.

In Chiapas, there is a wide range of native mangoes with diverse pigmentation, ranging from green to yellow, red and intermediate colors. While many of these mangos have not been commercialized, they constitute an important pool of genes that could help to improve commercial cultivars, mainly with regard to climate change adaptation, but also for nutritional value.

The accumulation of pigments is largely determined by the expression of genes involved in the phenylpropanoid-flavonoid biosynthetic pathway, such as the *PAL* and *CHS* genes, which are involved in the production of anthocyanin precursors. In some mango cultivars, high expression of these genes has been found to increase anthocyanin production in the fruit, which is reflected in higher nutritional quality, and an increase in the plant's defense mechanisms against adverse biotic and abiotic factors.

In this paper, the objective was to determine the expression of the *PAL* and *CHS* genes in green, yellow and red pigmented mango fruits from Soconusco, Chiapas, Mexico, at physiological maturity using RT-PCR. Results showed a higher level of expression of the *CHS* gene in the native germplasm than the *PAL* gene. The *CHS* gene was also found to have the highest expression levels in the green 'Tecolote' and 'Piña' mangoes, followed by the yellow 'Manililla' and 'Ataulfo' mangoes, and finally in the red 'Alcanfor' and 'Payaso' mangoes. These findings suggest that green mangoes produce higher amounts of anthocyanins, making them ideal as fruits with high nutritional quality and as candidates for use as rootstocks in commercial orchards.

Didiana Gálvez-López won the ISHS Young Minds Award for the best oral presentation at the XIV International Mango Symposium in Mexico in May 2025.

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Fungicidal activity of Mexican oregano (*Lippia graveolens*) essential oil against different *Colletotrichum* species associated with mango (*Mangifera indica*) anthracnose

› Thelma Guadalupe Valdez-Reyes

Thelma Guadalupe Valdez-Reyes is a senior student of Agricultural Engineering with a specialization in Crop Science at the Universidad Autónoma Chapingo (UACh), Mexico.

Her research is currently focused on evaluating the fungicidal activity of the essential oil of Mexican oregano (*Lippia graveolens*) against different isolates of *Colletotrichum* spp., a complex of fungi responsible for anthracnose, one of the main pre- and post-harvest diseases affecting mango (*Mangifera indica*) worldwide. The study assessed several parameters of the extract's fungicidal activity: mycelial growth inhibition (MGI), spore germination inhibition (SGI), minimum inhibitory concentration (MIC), and minimum fungicidal concentration (MFC) in isolates of *Colletotrichum asianum*, *C. siamense* and *C. tropicale*.

The essential oil was obtained through hydrodistillation and emulsified with Tween 20. Results showed that *C. asianum* was the most susceptible isolate (EC_{50} for MGI: 38.89 µg mL^{-1}; MFC: 216.67 µg mL^{-1}), whereas *C. siamense* exhibited greater resistance (MFC: 500 µg mL^{-1}).

The essential oil demonstrated remarkable potential as a natural fungicide, offering promising applications for disease control in sustainable and organic agricultural systems. This research contributes to the search for effective alternatives to chemical fungicides, whose indiscriminate use has led to resistance issues and concerns about toxic residues. It also highlights the value of plant-derived bioactive compounds as viable tools in plant pathogen management and crop protection.

Thelma Guadalupe Valdez-Reyes won the ISHS Young Minds Award for the best poster presentation at the XIV International Mango Symposium in Mexico in May 2025.

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Effect of salicylic acid, abscisic acid and methyl jasmonate under high temperature and water restriction in sweet cherry

› Francisco J. Maldonado González

In recent years, Chile has experienced significant shifts in climate, with increasing temperatures and reduced rainfall. These climatic changes have negatively impacted both the quality and quantity of sweet cherry (*Prunus avium*) yields by disrupting key physiological processes such as flower induction and differentiation, thereby reducing crop productivity. Chilean sweet cherry cultivars, notably 'SweetHeart' and 'Santina', are especially vulnerable to drought and heat stress, making adaptation strategies vital to sustain production and economic viability.

To address these challenges, research has turned to the application of phytohormones – plant growth regulators such as abscisic acid (ABA), salicylic acid (SA), and methyl jasmonate (MeJA) – to enhance the resilience of cherry trees under abiotic stress conditions. Experiments were conducted under both controlled conditions and in orchards to evaluate the effects of these substances on cherry plant tolerance to high temperatures and water deficits.

The key findings indicate that ABA effectively reduces stomatal conductance, helping the plant to remain in a low-activity, water-conserving state during stress. This enhances drought tolerance by minimizing water loss and maintaining turgor pressure, which supports better growth and fruit quality. SA was found to maintain stress tolerance levels comparable to ABA but also sustained higher photosynthetic rates and greater stomatal conductance, potentially supporting growth and productivity under moderate stress. On the other hand, MeJA did not produce significant improvements in stress tolerance, with physiological responses similar to untreated control plants.

The research highlights the importance of integrating phytohormones, particularly ABA and SA, into agronomic practices such as fertigation or foliar spraying to mitigate the effects of climate change on cherry production. While ABA and SA show promise as effective mitigation tools, further investigations are needed to clarify the mechanisms through which these substances enhance stress tolerance and yield. Advancing this knowledge is crucial for developing robust, science-based strategies that enable Chilean cherry growers to adapt to and thrive in an increasingly unpredictable climate.

Francisco J. Maldonado González won the ISHS Young Minds Award for the best oral presentation at the X International Cherry Symposium in USA in June 2025.

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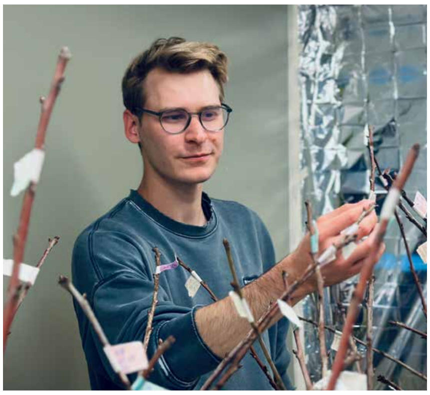
Integrating dormancy breaking agents into the PhenoFlex framework – insights from Chilean orchards



› Julian Nick Bauer

A key limitation of current phenological models is their reliance solely on natural chill accumulation, without accounting for the effects of dormancy breaking agents. These agents, primarily growth regulators, have become increasingly important for managing and synchronizing cherry production, especially in the southern hemisphere and in regions where winters are becoming too mild to meet chilling requirements naturally. To address this gap, we analyzed temperature data, bloom observations, and dormancy breaking agent application dates from 23 cherry orchards distributed along a latitudinal gradient in Chile. Based on this dataset, we developed four approaches to incorporate the effects of dormancy breaking agents into the PhenoFlex framework. As expected, our results confirm that assuming endodormancy completion at the time of application leads to systematically early bloom predictions. Approaches that added a fixed or scaled amount of chill did not perform well across the diverse climatic conditions in our dataset. In warmer regions, bloom was predicted too late, while in colder environments, predictions were too early, due to an overly high chill addition as a consequence of applying these dormancy breaking agents. Better results came from a method that compensated for insufficient chill by adjusting chill accumulation levels at the time of applying dormancy breaking agents. This created a balancing effect, where warmer locations with low natural chill received higher amounts of simulated extra chill, and colder sites with sufficient chill received only slight adjustments. Advancing these characteristics could be a promising strategy for improving approaches further. Future studies, with repeated measurements and comparisons between treated and untreated trees, will be crucial to better understand the interaction between dormancy breaking agents and the predictability of bloom dates. This work was conducted at the Pontifical Catholic University of Valparaíso in Chile. The findings contribute to our broader objective of improving phenological forecasts and enhancing the relevance of dormancy metrics, ultimately aiming to strengthen our ability to make robust and applicable predictions for temperate fruit orchards under future climate scenarios.

Julian Nick Bauer won the ISHS Young Minds Award for the best poster presentation at the X International Cherry Symposium in USA in June 2025.

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Dynamic lighting for growing watermelon scion seedlings in a PFAL

› Anna Gkotzamani

Anna Gkotzamani is an agronomist specializing in vegetable crops and sustainable agricultural production systems. She is a first-year PhD candidate in the Department of Horticulture at Aristotle University of Thessaloniki, Greece. Her research focuses on the effects of dynamic environmental fluctuations, primarily in plant factories with artificial lighting (PFALs), on the growth, physiology, and quality of vegetable seedlings. High-quality seedlings are critical for successful crop establishment and lateral development, especially under the constraints of non-fully controlled conditions and limited space in traditional greenhouse nurseries. PFALs offer the advantages of a fully controlled, adjustable environment and vertical farming system that supports improved seedling quality and higher production efficiency. In her award-winning presentation, Anna presented findings on the production of watermelon scions under dynamic LED-lighting in a PFAL. The study showed that carefully timed and combined light regimes can significantly enhance seedling vigor. These results are promising for producing high-quality seedlings, while also increasing yield and resource-use efficiency, and optimizing production planning.

Anna Gkotzamani won the ISHS Young Minds Award for the best oral presentation at the IX International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops and III International Symposium on Vegetable Grafting in Greece in June 2025.

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The world of Horticulture

The diversity of horticulture in Japan – Japanese gardens

Takashi Awano

History and style of Japanese gardens

In Japan, natural landscape gardens first appeared during the Nara period, about 1,300 years ago. However, some scholars argue that the original form of Japanese gardens dates back to the Jomon period (14,000 BC - 10th century BC), based on the fact that chestnut trees were planted at the Sannai Maruyama site in Aomori Prefecture, and stones were set into the ground in circles at the Washinoki site in Hokkaido. During the Kofun period (mid-3rd century - 7th century), civil engineering techniques for creating gardens were developed, such as covering burial mounds with roofing stones and building moats around them.

In the birth of Japanese gardens, it is apparent that the garden culture from both China and Korea had a major influence. In Korea, square ponds were created in gardens from the Baekje period (mid-4th century - mid-7th century), only to appear in Japan during the Asuka period (late 6th century - early 8th century), when square ponds were found at the Ishigami site (Nara) and at the remains of gardens at the Shimanosho site (Nara).

Heijo-kyo, the capital during the Nara period, is said to have been modelled on Chang'an, the ancient Chinese capital of the Tang dynasty. The vast garden called Shorin-en, located to the north of Heijo-kyo, is planted in the same direction as the Western Inner Garden of Chang'an (Figure 1). A garden pond called Qujiangchi was established in the southeast corner of Chang'an: an artificial pond called Gotoku remains in a similar location in Heijo-kyo. As the two palaces have a very similar layout, it is logical to conclude that the ideas were copied.

These ancient gardens were used as places for entertaining aristocrats and holding banquets. The gardens were of two varieties (Shinden-zukuri style and Pure Land). In the mansions of the aristocrats using the Shinden-zukuri style, a pond was dug in the southern garden area, an island was placed in the pond, a bridge was built over the pond, and water was drawn into the pond through a stream.

As the idea of "Mappo Shiso" (the End-of-the-World Theory) spread during the Heian period (794-1192), Pure Land gardens were created. A good example of a Pure Land garden is the Byodo-in Garden in Uji, Kyoto. The Amida Hall was placed at the center, with the other buildings connected by corridors. A pond, with an island in the front, and a bridge occur along the same straight line. Pure Land gardens were characterized by their frontality and spatial symmetry. This garden style spread to the gardens of Hiraizumi in Oshu. In particular, the Muryoko-in Garden (Iwate) and the Motsu-ji Garden (Iwate) are considered to be fine examples of Pure Land gardens.

Figure 1. East Palace Garden at Nara Palace site, provided by Nara National Institute for Cultural Properties.

The development of stone arrangements and the birth of dry landscape gardens and tea gardens

From the Kamakura to the Muromachi periods (1333-1573), stone arrangements were developed in temple gardens. The gardens of Jisho-ji, Tenryu-ji and Rokuon-ji (Kyoto) are said to be masterpieces, with their pond banks decorated with dramatic stone arrangements. This first began when Buddhist Zen monks, as part of their training, created gardens by erecting stones. The development of stone arrangements gave rise to the style known as "karesansui".

Placing natural stones in a garden is a distinctive feature of Japanese gardens. Western gardens are based on the idea of conquering nature, and so they arrange stones and create flower beds and fountains. Japanese gardens, on the other hand, are based on the idea of harmony with nature. They believe that a waterfall stone arrangement, where water flows from a high place to a low place, is closer to nature than a fountain.

The tea gardens completed by Sen no Rikyu came to be called "Roji". They were decorated with stepping stones, stone basins and lanterns. These were eventually introduced into the gardens of feudal lords and town houses, and have become indispensable elements of modern Japanese gardens.

From the mid-Muromachi period onwards, dry landscape gardens were established mainly in the Zen temples in Kyoto. Well-known examples are the Ryoan-ji garden, with 15 stones set in the southern garden of the abbot's chamber (Figure 2), and the Daitoku-ji Daisen-in garden, which depicts a dry

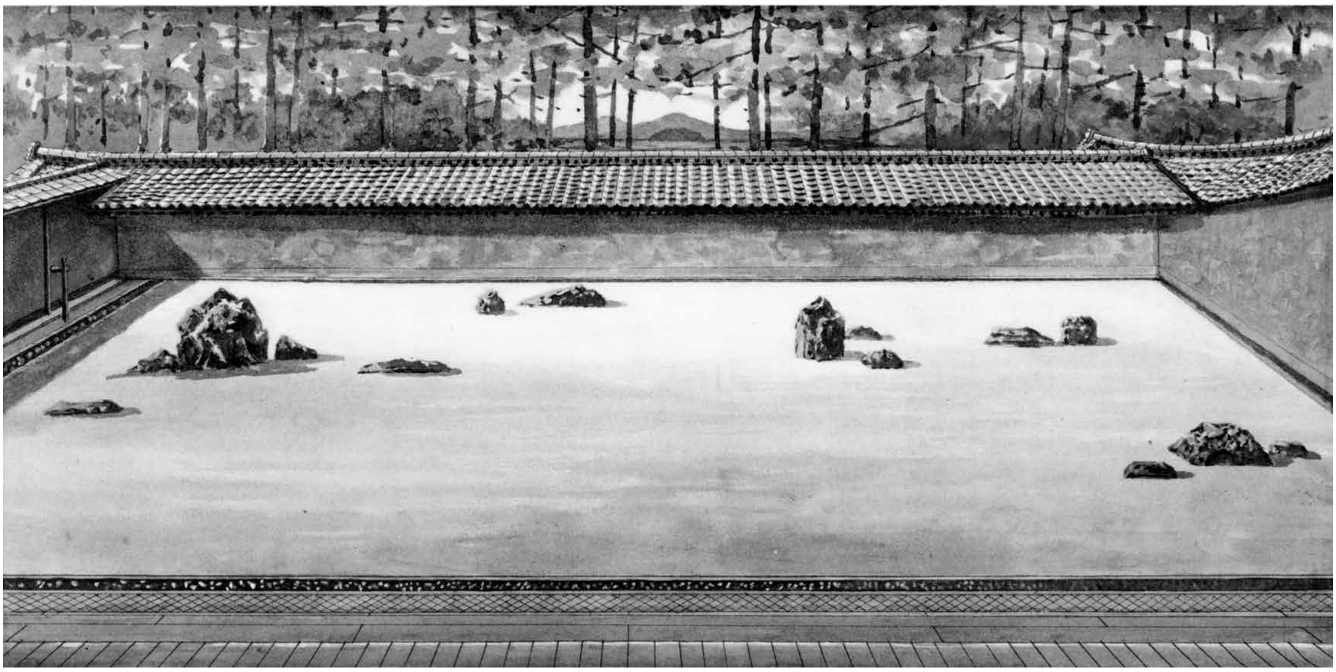

Figure 2. The Ryoan-ji garden. Source: Honda Kinkichiro, "Illustrated Collection of Famous Gardens of Japan", 1911.

waterfall stone arrangement and dry stream in the style of a landscape painting.

When "Shoin-zukuri" was introduced to homes and temples in the Medieval Ages, "Shakkei" (borrowed scenery), played an important role, emphasizing the view outside the garden. Shoin-zukuri architecture developed a way of framing the garden and viewing it from indoors. Entsu-ji Garden, with Mt. Hiei as its main view, and Jiko-in Garden, which borrowed the view of the Nara Basin and its villages, are both well known. The Shugakuin Imperial Villa Kami-no-ochaya Rinuntei, with its deep eaves and shallow verandas, acts as a frame to include the large cluster of trees and Yokuryu Pond, while also allowing a distant view of Kitayama. It can be said that Shakkei was a world-class technique born in Kyoto, as it was surrounded by Higashiyama, Mt. Hiei, Arashiyama, Kitayama, and other mountains.

Strolling Garden: transformation into amusement spaces

A dramatic change in garden style emerged in the early modern period (1573-1868) with the birth of the Strolling Garden (Daimyo). A large pond was placed in the center of the site and surrounded by thick forest to isolate it from the outside world. Garden paths were arranged around the pond so that visitors could stroll around the entire area. This garden style can be seen in the gardens of Katsura Imperial Villa and Shugakuin Imperial Villa (Kyoto), known as imperial court gardens, but it can also be seen in many of the gardens established by the feudal lords throughout Japan, such as Korakuen in Okayama, Kenrokuen in Kanazawa (Figure 3), and Ritsurin Garden in Takamatsu.

Daimyo gardens are arranged around a pond with attractions such as artificial hills, plum groves, and tea gardens (Figure 4). Visitors enjoy the sequential scenery of the garden as it changes from one view to another while walking along the garden paths, or from floating boats on the pond, and admire the vast sky that spreads above the garden. Many of these gardens were built in the Ninomaru space of castles belonging to feudal lords and can be found today at the famous Nagoya Castle Ninomaru Garden and Ako Castle Ninomaru Garden.

A distinctive feature of these feudal gardens was that the entire garden was developed as an amusement space. Many of the gardens had flower viewing areas and teahouses.

Figure 3. Kenrokuen in Kanazawa.

Figure 4. Genkyuen in Hikone.

Suizenji Jojuen in Kumamoto even had a representation of Mount Fuji, and the Toyama Villa of the Owari Tokugawa clan in Edo had an exact replica of the main street of Odawara.

In addition to structures based on teahouses and designs based on Japanese and Chinese culture, these daimyo gardens often had an archery range, a horse riding area, or a duck pond.

Korakuen, built by the Mito Tokugawa family, is a masterpiece of a daimyo garden, with a large pond and Horai Island at its center. It also features famous Japanese sites such as Tsutenkyo Bridge, Oi River, Shiraito Falls, as well as famous Chinese sites such as Shorozan and the banks of Lake Sai. It is all incorporated into the garden through the technique of "Mitate".

The birth of Western-style gardens and the innovation of Japanese gardens

The lifting of isolationism and opening-up to the world at the end of the Edo period (1603-1868) saw the rapid adoption of Western gardening styles. Along with modernization and enlightenment, Western-style gardens with spacious lawns became popular in the residential gardens of the imperial family, politicians and businessmen. From the end of the Meiji period to the Taisho period (1912-1926), the architect and landscape architect Josiah Conder promoted the westernization of residential gardens, as can be seen in the gardens of the former Iwasaki Yanosuke residence and the former Furukawa Toranosuke residence.

However, Yamagata Aritomo, an elder statesman of the Meiji era, rejected artificial gardens and instead made full use of the surrounding natural environment. Yamagata's gardens became known as "Naturalistic gardens" (Figure 5).

These gardens were rich in rustic charm, with broad lawns and gracefully meandering streams, and did not use symbolic landscaping techniques such as Sanzon-seki (triad stones), Crane Island, and Turtle Island. Moreover, they were bright and open.

Many wealthy politicians and businessmen built mansions and villas in Tokyo and constructed grand gardens. People known as "Kindai Sukisha" (Modern style connoisseur for tea ceremony) would come to these gardens to practice the tea ceremony. They built mansions in Shitaya Negishi (Figure 6), Takanawa and Kojimachi Bancho, introducing the natural scenery of Nasu-Shiobara in Tochigi, with its beautiful valleys and waterfalls, into their gardens.

During the Showa period (1926-1989), the idea of naturalistic gardens was further developed. Past techniques and concepts led to the creation of a style known as the "Zoki garden" (miscellaneous trees garden). Zoki is the garden style that rejects trimmed plants and instead uses deciduous broad-leaved trees that were not previously recognized as garden trees, such as Japanese Snowbell, Japanese Stewartia, Yedo Hornbean and Konara Oak. These trees were arranged in a natural style with the frequent use of waterfalls and streams.

Zoki gardens were widely introduced into Sukiya-style architecture such as homes, restaurants and inns. Zoki gardens suit not only traditional residential architecture but also modern concrete buildings and are still widely created today as a modern garden style.

Gardens that combine Japanese and Western styles

In Japan, there are places called "Yamate" or "Yamanote". These are "high and dry places" as opposed to "Shitamachi", which refers to lowlands. In Tokyo, Yamanote refers to the western part of Tokyo, including the Yamanote Plateau. In Yokohama, the high ground facing the hills is called Yamate, and in Kobe, the southern foot of Mount Rokko is also called Yamate. The desire to live on high ground with good sunlight and views spread among the upper classes and wealthy people during the Meiji period. These areas still exist today as high-end residential areas.

In the mansions and villas of the privileged classes such as the imperial family and the nobility, as well as high-ranking government officials and businessmen, it was fashionable to build the main house on high ground to emphasize views, and to have a spacious garden with a lawn around the main house (Figure 7). A lawn garden was established with gently curving paths on a spacious lawn, with rounded, trimmed shrubs and garden stones placed here and there to harmonize with both Japanese and Western buildings. Lawns also played an important role as venues for garden parties, which became a popular way to socialize.

A common characteristic of these mansions was that they featured a Western-style garden and a Western-style house, all placed together on top of a plateau. As the lowlands below the embankments were usually wet, a Japanese-style pond garden was more logical. This created a "Japanese and Western-style juxtaposition garden" with a Western-style garden on the plateau, a waterfall on the slope, and a Japanese garden in the lowlands.

Figure 5. Murin-an Garden, designed by Yamagata Aritomo and Ogawa Jihei VII. Source: Kyoka Rinsencho, edited by Yumoto Fumihiko, Kyoto Prefecture, 1909.

Figure 6. Bushoan tea garden at the main Negishi residence. Source: "Illustrated Guide to the Teahouse and Tea Garden" by Sugimoto Buntaro, Kenchiku Shoin, 1911.

■ Figure 7. Iwasaki Hisaya residence garden in Shitaya Kayacho, owned by Awano.

Concluding comments

Japanese gardens are made up of plants, stones, water and soil, and their basic approach is to express the beauty of natural landscapes such as mountains, valleys, coasts, oceans and the countryside. This approach has been passed down continuously from the Asuka and Nara periods to the present day. Japanese gardens are highly regarded for their unique beauty around the world. Our ancestors not only appreciated the beauty of the land, but found multiple ways to express that beauty symbolically, dynamically and dramatically.

› About the author

› Takashi Awano

Dr. Takashi Awano is a professor at Tokyo University of Agriculture, Japan, specializing in landscape architecture and the history of Japanese gardens. His research focuses on the historical development, design principles, and cultural significance of Japanese gardens, particularly those established during the Japanese colonial period in regions such as Taiwan and South Korea. Professor Awano has conducted extensive studies on the spatial composition and transformation of historical gardens, contributing to the preservation and understanding of Japan's landscape heritage. E-mail: t3awano@nodai.ac.jp

Gardens of ponds and islands, white sand and stones – a guide to Kyoto's gardens

Tomoki Yamauchi

Kyoto was, from 794 until 1869, the Heian capital of Japan. As a city of considerable political and cultural importance, the gardens of Kyoto, including archaeological remains, provide gardens from every period and style, ranging from ancient to modern in an unbroken continuum. Over centuries, a mosaic of diverse gardens have been constructed in accordance with the social strata, cultural backgrounds and beliefs of people, ranging from aristocrats to townsfolk. In 2026, Kyoto will provide the venue for the 32nd International Horticultural Congress (www.ihc2026.org). To provide visitors and garden enthusiasts with a guide to Kyoto's historical gardens, I have grouped them into two broad categories: gardens of ponds and islands and gardens of white sand and stones. This division inevitably leaves out many gardens, including those focused on *roji* (the tea ceremony), or the naturalistic gardens of the Meiji period and the courtyard gardens of the *machiya* townhouses. Let us begin with Nijō Castle, which is scheduled as one of the congress excursions.

Gardens of ponds and islands

Nijō Castle (Nakagyō Ward, Kyoto) was begun in 1602 by Tokugawa Ieyasu (1543-1616), who had prevailed at the Battle of Sekigahara. The castle served as the shōgun's residence in Kyoto, as a venue for political ceremonies and, at the end of the Edo period, as the historical stage on which the shogunate returned political authority to the emperor. The Ninomaru Garden comprises an island-studded pond with black pines and gentle undulations. It is viewed from the west side of the zigzag-arranged halls and shoin (Figure 1).

In 1626, in anticipation of a visit by Emperor Go-Mizunō (1596-1680), the southern part of the garden was remodelled by Kobori Enshū (1579-1647), a technocrat of the shogunate. Although the group of buildings added at that time was later relocated or removed, surviving design drawings show that along the southern side of the pond, an imperial palace for the visit and a fishing pavilion were installed. From the present condition of the southern revetment stonework, it is inferred that stones were added or repositioned so as to accommodate an imperial viewpoint (Figure 2).

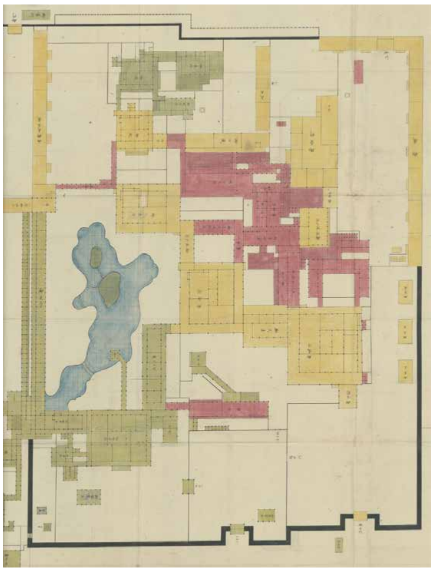

Figure 2. "Plan of Nijō Castle" (Kyoto University Library; detail, north oriented upward; https://rmda.kulib.kyoto-u.ac.jp/item/rb00021809).

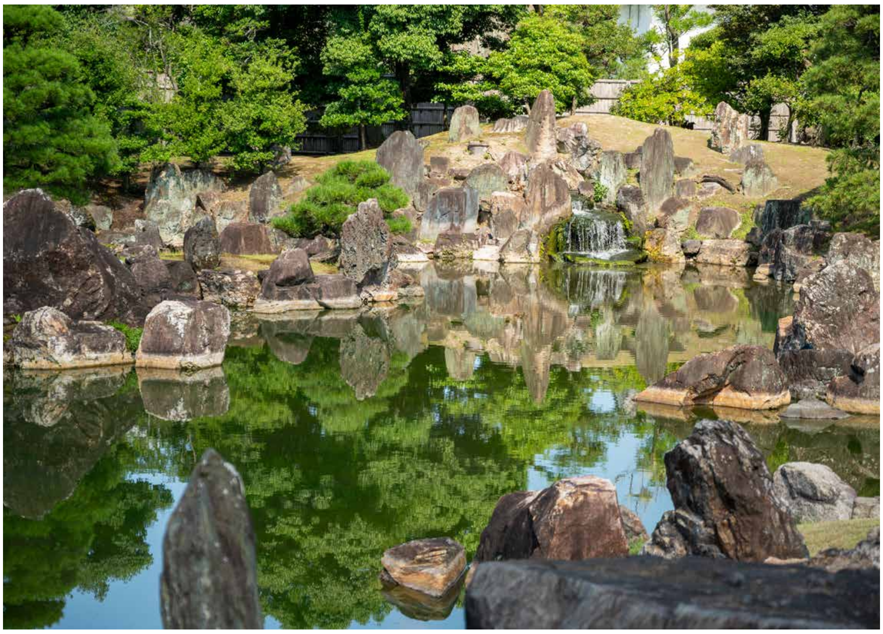

Figure 1. The Ninomaru Garden of Nijō Castle features a striking composition of ponds and islands – or bold arrangements of stones and pine trees (All garden photographs below were taken by the author).

The revetment stonework of the Ninomaru Garden is not merely intended to protect the water's edge: it is so grand in scale that it constitutes the garden's principal scenic feature, and the vigorous black pines produce an impression of excessive magnificence. This results from a design where the garden is viewed in close conjunction with the architecture and the sumptuous interior decorations, beginning with the Kano-school wall paintings. One may observe how Japanese gardens treat stone compositions as key scenic elements and, among the plants, emphasize the black pine.

Another garden that displays such magnificence is the Sampō-in Garden of Daigo-ji (Fushimi Ward, Kyoto) (Figure 3). Construction began in 1598 by Toyotomi Hideyoshi (1537-1598), who wielded power in the preceding Azuchi-Momoyama period. After his death, it was completed by Gien (1558-1626). Like the Ninomaru Garden of Nijō Castle, the design centres on a pond before the shoin in which

Figure 3. Three-tiered waterfall seen across the pond in the Sampō-in Garden, Daigo-ji Temple.

Figure 4. The present-day Shinsenen bears little trace of its former grandeur.

an island floats. It too is furnished with powerful revetment stonework and accent stones. However, unlike the Ninomaru Garden, the Sampō-in Garden features a large change in elevation, something impossible to express with an artificial hill. The drop, created by the stonework and the three-tiered waterfall, provides a compelling force. Nevertheless, the garden simultaneously enjoys an expansiveness in that it blends seamlessly with the mountain that forms its backdrop.

I started my discussion of Kyoto's "Gardens of Ponds and Islands" with the Ninomaru Garden primarily because the castle came into being by reclaiming and overwriting part of an older garden created during the Heian period. When you leave Nijō Castle, please proceed to the unremarkable little pond that adjoins its southern edge. Though little remains, Shinsenen is the surviving remnant of a vast imperial garden that predates the construction of both the Ninomaru and Sanbō-in gardens by eight centuries.

Once adjoining the southeastern edge of the Daidairi of Heian-kyō, it was a pleasure ground where Emperor Kanmu (737-806) and his successors frequently came for boating, banqueting and viewing the blossom (Figure 4). Springs fed a winding watercourse (yarimizu) and pond that was once of an enormous scale, stretching from what is now the southern edge of Nijō Castle's Honmaru in the north to today's Sanjō Street in the south. In short, Nijō Castle was built by reclaiming the northern part of Shinsenen and drawing its spring water into the new design. In its prime, on the northern side of Shinsenen, stood the *Kenrinkaku*, which was flanked east and west by wings and a fishing pavilion (*tsuridono*). A stream drawn from the northeast flowed south of *Kenrinkaku* into a large pond that contained a central island. The arrangement of these elements within Shinsenen is regarded as one of the prototypes for the aristocratic mansions (*shinden-zukuri*), together with their integrated *shinden-zukuri* gardens that became formalised from the mid-Heian period onward.

The style of floating an island in the garden pond was, in the late Heian period, handed down into the Pure Land gardens that sought to represent the Western Paradise that was believed to lie toward the west. Although these gardens lie some distance south of Nijō Castle and Shinsenen, the Byōdō-in Garden, founded in 1053 (Uji, Kyoto Prefecture), and the Jōruri-ji Garden, founded in the eleventh century (Kizugawa, Kyoto Prefecture) (Figure 5), are cases in point. What matters is the changes that occurred: first, the direction of primacy shifted from north to west; second, the master of the architecture changed from a human being to Amida Buddha; and, third, the axis of viewing was consequently reversed. In Shinsenen and in *shinden* gardens, one viewed the pond and its island, which spread southward, from buildings situated on the northern side of the site. At Byōdō-in and Jōruri-ji, however, the main hall, whose master is not a human but Amida Buddha, is set on the west, where the focus shifts from looking at the garden from the building to looking at the building from the garden or across the garden pond, and worshipping the Amida Buddha seated within. Even so, the essential elements of the garden are here again, as in Shinsenen and the *shinden-zukuri* gardens: a pond with an island, where the shoreline, like that of the *shinden-zukuri* gardens, is a gentle beach (*suhama*) paved with rounded river stones. The *suhama* is composed of soft, graceful curves, and although its impression contrasts with that of the Sampō-in Garden and the Ninomaru Garden, whose entire waterside is formed of massive revetment stonework, the garden composition, in which

Figure 5. Amida Hall of Jōruri-ji, situated on the western side, viewed from the opposite bank.

Figure 6. Shōkintei teahouse in the Katsura Imperial Villa Garden, viewed across the pond.

Figure 7. Taihei-kaku bridge pavilion in the Shin'en Garden of Heian Shrine, viewed across the pond.

Figure 8. The Daisen-in Study Garden appears to recreate the landscape of an ink painting.

an island floats in a pond and is planted with vegetation, remains.

This composition of the "Gardens of Ponds and Islands" includes multiple stylistic variants, yet its vestiges may be observed in the Katsura Imperial Villa Garden (Nishikyō Ward, Kyoto) (Figure 6), built in the early Edo period by the princely father and son Prince Toshihito (1579-1629) and Prince Toshitada (1619-1662), and in the Shin'en Garden of Heian Shrine (Sakyō Ward, Kyoto) (Figure 7), created as a public work by the Meiji-period gardener Ogawa Jihei (1860-1933).

Gardens of white sand and stones

Another lineage essential to Kyoto's garden history are the "Gardens of White Sand and Stones". The *kare-sansui*, which took shape in the mid-Muromachi period, are often called the "Zen garden". Unlike the gardens introduced thus far, this comparatively recent lineage contains neither ponds nor islands, scarcely any undulating terrain, and few plantings. It is a waterless, level garden, whose surface is spread with white sand upon which stone compositions are set. In this sense, the "Gardens of White Sand and Stones" differ completely from the "Gardens of Ponds and Islands". Whereas the latter are expansive gardens endowed with abundant components and a sense of vitality, the former constitute an inorganic, ascetic lineage produced by paring the components down.

During the Heian period, between the *shinden* and the pond to its south, there was a flat stage for ceremonies. Often this space was spread with white sand and called the *Nan-tei* (south garden). Around the same period, it was not uncommon to place stone compositions at the edge of the terrain in *shinden* gardens. In short, it was a localized scene within older gardens, which were rich in compositional elements, that came to be singled out and appreciated as an independent object of viewing in later periods. Hence kare-sansui, in its present sense, emerged.

The shoin garden of Daisen-in, a sub-temple of Daitoku-ji, is thought to have been laid out in the late Muromachi period (Kita Ward, Kyoto) (Figure 8). In one corner of a plot spread with white sand, this garden builds a low, small, L-shaped artificial hill and, shoring up its edges, sets up so many standing stones that they cover the mound. Against a backdrop of clipped evergreens, large upright stones stand high and vertical. Between them, slightly lower, bluish stones are placed, and from the foot of these blue stones, a narrow band of white sand is laid down to the expanse of white sand below the mound. Because a stone bridge spans this base of white sand, we believe that the sand is being likened to water. The vertical stones represent precipitous mountains, while the lower blue stones set among those mountains, represent a waterfall, each element expressed in a different material. This miniature garden, which was likely viewed from within the shoin through a rectangular frame defined by the eaves and the garden-side veranda, must have appeared as an unfolding of the landscape paintings imported from China at the same time. Daisen-in also possesses a south garden of the hōjō, yet in this garden there is only a modest cone-shaped heap of white sand, and a flat expanse of white sand spreads out. This vacant space is precisely the background space for *kare-sansui* that appears repeatedly around the buildings.

From the garden of Daisen-in, proceed to the nearby Zuihō-in Garden, another sub-temple of Daitoku-ji (Kita Ward, Kyoto) (Figure 9).

Figure 9. Stone composition in Zuihō-in Garden, suggesting rough waves on a sea of white sand.

Figure 10. Rugged rock islets rising from a sea of white sand in the Honbō Garden of Tōfuku-ji.

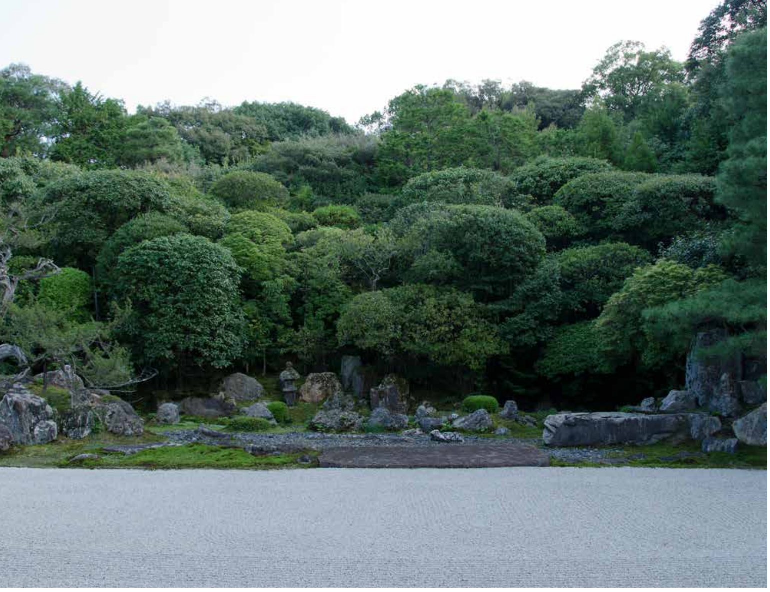

Figure 11. Konchi-in Garden with Turtle Island on the left, Crane Island on the right, and Mt. Hōrai at the rear.

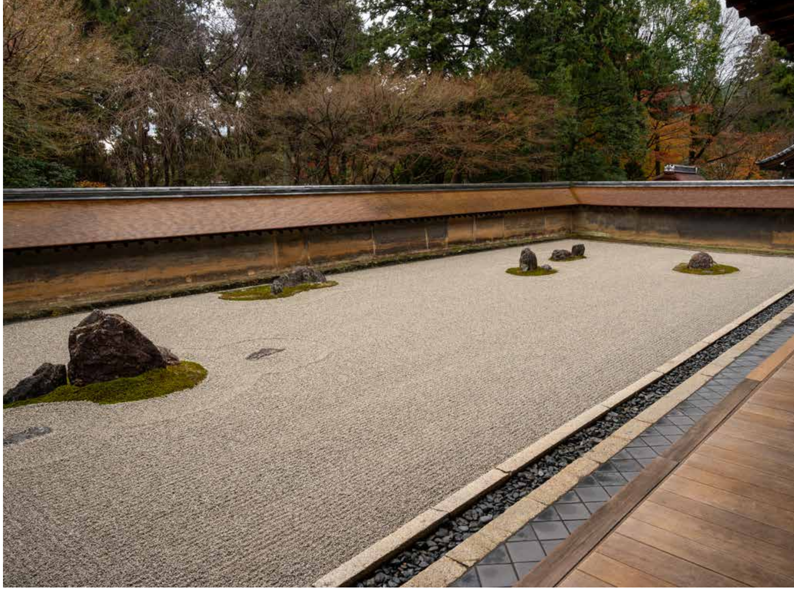

Figure 12. Hōjō Garden at Ryōan-ji, viewed from the northeast corner.

Designed in 1961 by Shigemori Mirei (1896-1975), who was also a historian of garden art, this garden sets stones from the summit of an artificial hill and a cluster of vertical standing stones in the rear corner, in an arc like a chain of peaks. One line takes the narrow, cape-like form of a tongue that cleaves the garden and extends to a distant rock islet driven into the sand, while the other proceeds from a small promontory to several scattered rock islets.

Aware of the famous kare-sansui at nearby Daisen-in, this garden, though iconographic, appears to miniaturize the actual structure of capes even more than a landscape painting would, and its rough sand ripples clearly evoke the sea. Among Shigemori's kare-sansui, there is also his debut work, the Honbō Garden of Tōfuku-ji (Higashiyama Ward, Kyoto) (Figure 10), in which, within a white-sand space conceived as the sea, he composes islands beginning with Hōrai Island.

If one wishes to see an elaborate composition of sea and islands created with white sand and stones, it may be worthwhile to visit the Konchi-in Garden (Sakyō Ward, Kyoto) (Figure 11), designed in the early Edo period by Kobori Enshū, who remodeled the southern section of the Ninomaru Garden. Built in the south garden of the hōjō to welcome Tokugawa Iemitsu (1604-1651), this kare-sansui, while leaving in the foreground a flat white sand space characteristic of a south garden, constructs, by means of an artificial hill and stone compositions, Turtle Island and Crane Island to left and right, praying for Iemitsu's longevity, with Mt. Hōrai at the back. Particularly conspicuous in this garden, if one were to replace the white sand space of the Konchi-in Garden with water, one would see that its composition closely approximates that of a "Garden of Ponds and Islands" in which stone compositions are set along the edge of a pond. On the way back, stop by Murin-an, a modern garden from the Meiji period, located nearby.

In the Ryōan-ji Temple Garden (Ukyo Ward, Kyoto) (Figure 12), which is thought to have been created between the late Muromachi and early Edo periods, such concrete evocations of natural scenery recede. Enclosed by earthen walls, this perfectly rectangular space is entirely spread with white sand. The only plantings are a mere scattering of moss, and although several viewing stones are set in place, the stones are comparatively small, so that the greater part of the garden is left as a blank white expanse. During the Heian period, stone compositions in *shinden*-style gardens were often placed along the edges of changes in the terrain. Similarly, in the gardens of Daisen-in and Zuihō-in, upright stones are set at the slopes of small artificial hills, yet this garden is virtually flat. Even though there is a slight mound beneath each stone, the stones rise abruptly from the planar white sand, almost entirely unconnected to the topography. Considering that in the natural world stones tend to be exposed where the landform changes, the garden offers no reason why the stones appear where they do. Instead, people delight in their purely abstract, plastic arrangement. The stone groupings lack any rationale and have elicited a multitude of interpretations. Perhaps for this reason, this garden has become influential not only within Japan, but also internationally, making it one of the most notable candidates among the "gardens of white sand and stones" to visit. After viewing this garden, a visit to the nearby Rokuon-ji (Golden Pavilion) is highly recommended.

Throughout this essay, Kyoto has been taken as the field of study, and Japanese gardens have been introduced by dividing them into two broad lineages: "Gardens of Ponds and Islands" and "Gardens of White Sand and Stones." While many other significant gardens and stylistic currents could be cited, setting these two poles provides a useful perspective from which to appreciate the richness and diversity of Kyoto's garden heritage. These examples, of course, represent only a portion of what the city offers. During your stay in Kyoto in the summer of 2026, should time permit, wander at will and discover its many celebrated gardens for yourself.

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The diversity of horticulture in Japan – nursery production

Masayoshi Nakayama, Masaki Ochiai, Kazuo Ichimura and Kunio Yamada

Within Japan, ornamental trees and shrubs are produced for cut flowers, cut branches, potted plants and for amenity horticulture, where trees and shrubs are planted in parks and gardens and roadside verges for aesthetic purposes.

Ornamental tree production as cut flowers

Roses, hydrangeas, flowering cherries, peaches and apricots, camellias and mimosa are widely produced as cut flowers in Japan. While cut flowers of herbaceous plants such as chrysanthemums, carnations and roses are produced all year round, cut flowers of flowering trees and shrubs are mostly seasonal items. This is due to the large plant size and their flowering characteristics such as vernalization, which makes it difficult to establish year-round production.

Within Japan, cherry blossoms, flowering peaches, Japanese apricots and camellias have a long history as ornamental trees dating back to the 8th century. They have each become enshrined in Japanese culture and have an important role as floral materials that express the seasons. This is yet another reason why year-round production does not take place.

Cut branches, which include flowering trees and shrubs and ornamental foliage, accounted for approximately 6% of the value of cut flower shipments in 2023 (Ministry of Agriculture, Forestry and Fisheries, 2024). They are important materials for enhancing floral arrangements and bouquets, where natural designs with soothing colors have become increasingly popular in recent years. In addition, sakaki (*Cleyera japonica*), hisakaki (*Eurya japonica*), and shikimi (*Illicium anisatum*) are widely produced as branches for Buddhist and Shinto altars and graves, although they are classified as forest products rather than cut branches of cut flowers.

Ornamental tree production as potted flowers

A wide variety of flowering shrubs and trees are also produced as potted plants. While many items have a limited shipping season, perpetual blooming miniature roses are available all year round. Ume and cherry trees, tailored to resemble bonsai in early spring, azaleas and fuchsias in spring, hydrangeas in early summer, hibiscus and bougainvillea in summer, poinsettia at Christmas, and ericas and boronia in winter are all widely available. As potted plants, flowering shrubs and vines are required to be compact. Because long-term cultivation by consumers is not expected, high ornamental value is the priority. Tropical flowering plants that are susceptible to low temperatures and cool climate flowering plants that are susceptible to high temperatures and humidity are also produced extensively.

Flowering trees, shrubs and vines accounted for 16.5% of all potted plant shipments, while ornamental foliage plants accounted for 23.3% (Ministry of Agriculture, Forestry and Fisheries, 2024).

Ornamental tree production as garden flowers

Shipments of ornamental trees and shrubs for planting in gardens were worth 15.8 billion JPY in 2022, a small market compared to cut flower production (JPY 211.3 billion), potted plants (96.5 billion JPY) and flower seedlings (33.1 billion JPY) (Ministry of Agriculture, Forestry and Fisheries, 2023).

By prefecture, production is particularly high in Chiba and Fukuoka prefectures, followed by Mie and Aichi prefectures. These four prefectures are the main production areas and are all located relatively close to large cities. Within each prefecture, Sosa City (Chiba Prefecture), Kurume City (Fukuoka Prefecture), Suzuka City (Mie Prefecture) and Inazawa City (Aichi Prefecture) are famous garden tree production areas. Kagoshima Prefecture is the second largest producer after the top four prefectures, taking advantage of its warm location in Japan.

For commodities with high distribution volumes, a single commodity is produced in a field, whereas for commodities with lower distribution volumes, multiple commodities are often produced in one field (Figure 1).

The following is a list of the flowering trees and shrubs that are frequently used for garden planting in Japan, arranged according to the flowering season. Because Japan is a long country from north to south and as many of the plants cultivated in Japan are dormant in the cold winter, the flowering season and suitability for cultivation varies significantly from region to region.

Figure 1. Tree nursery. Seedlings of various species and ages are grown in the same plot.

Figure 2. Japanese plum garden established in parks for flower viewing.

Figure 3. Cherry blossoms (“somei-yoshino”) planted in public space. People can be seen relaxing and enjoying refreshments under the trees during the blooming season.

Figure 4. Rose garden.

Figure 5. Wisteria vine pergola.

- March: Japanese apricot, magnolia (especially *Magnolia liliiflora*, *Magnolia kobus*, etc.), cherry blossoms, peach flower, mimosa, daphne, *Spiraea thunbergia*, *Forsythia* × *intermedia*, *Pieris japonica*;
- April: dogwood, tsutsusi azalea, rhododendron (especially subgenus *Hymenanthes*), *Spiraea cantoniensis*, Japanese kerria (*Kerria japonica*), *Enkianthus perulatus*, *Cercis chinensis*, *Loropetalum chinense*, peony (especially *Paeonia suffruticosa*, *Paeonia lactiflora*, etc.);
- June: rose, satsuki azalea, Japanese wisteria (*Wisteria floribunda*, etc.), Japanese snowbell, *Rhaphiolepis umbellate*;
- July: hydrangea (especially *Hydrangea macrophylla*, *Hydrangea paniculata*, etc.), gardenia, hypericum (especially *Hypericum monogynum*, *Hypericum patulum*, etc.), abelia;
- Summer: Hibiscus (including *Hibiscus mutabilis* and *Hibiscus syriacus*), *Lagerstroemia indica*;
- Autumn: *Osmanthus fragrans*, *Camellia sasanqua;*
- Winter: *Leptospermum scoparium*, heath (especially *Erica canaliculate*, etc.), *Chimonanthus praecox*, witch hazel (*Hamamelis japonica*), *Camellia japonica.*

While a limited variety of flowering trees and shrubs are used for street trees and public parks and gardens, a wide variety of flowering trees and shrubs are used for planting in private gardens. *Rhododendron* section Tsutsusi and *Camellia sasanqua* have a particularly high consumer demand. Both species respond well to pruning and flower well, making it easy to control the shape of the tree or to form low-height hedges. In addition, because they are bred from wild species in Japan, they have adapted to the Japanese environment and are easy to cultivate and manage. Plum trees, cherry trees, roses, wisteria (*Wisteria floribunda*) and hydrangeas are sometimes planted on a large scale with multiple varieties of each by themselves, and many of these have become major tourist attractions (Figures 2-5).

Due to the small size of the market and the difficulties experienced in breeding woody plants, only a few people are engaged in breeding new varieties and cultivars. Therefore, the introduction of novel plants from abroad is an important means of enhancing the diversity of flowering trees and shrubs in Japan. In recent years, there has been growing interest in Australian native tree species such as *Melaleuca*, *Westringia*, *Protea*, *Serruria* and *Leucadendron*. However, when introducing flowering trees and shrubs from overseas, adaptation to the Japanese environment, which is hot and humid in summer and below freezing in winter, is a very important consideration.

Camellia

Camellia is one of the most familiar flowering trees in Japan. The group of horticultural varieties derived mainly from hybrids of *Camellia hiemalis* and *Camellia japonica*, which are both native to Japan, are called Tsubaki in Japan. Breeding of this group began in the Muromachi period (1336-1573) and many garden varieties appeared during the Edo period (1603-1867) and were used as cut flowers for traditional Japanese tea ceremonies and as garden plants.

The group of horticultural varieties derived mainly from *Camellia sasanqua* or hybrids of *Camellia sasanqua* and related species, which are also native to Japan, are called Sasanqua (Hakoda, 1987). Sasanqua is often used as a hedge because of its tolerance to pruning, its robustness, the flowering season (fall to winter when flowering plants are scarce), scent, short plant height, and small evergreen leaves (Figure 6). Kan-tsubaki (*Camellia* × *hiemalis*), a group of sasanqua varieties, are often used for short hedges because its flowering season is from November to March when few other plants are in bloom, and because its trees are lower in height and have strong horizontal growth. Because these plants tolerate pruning, they can be pruned and trimmed into various shapes.

Cherry blossom

Cherry blossoms are perhaps the most famous flowering trees in Japan. Although it is a tall tree with a short flowering season, the entire crown of the tree is covered with pale pink or white flowers. It is a special tree in Japan because it blooms from the end of March to the beginning of April. After the cold winter, cherry blossoms signify the beginning of spring, the coming of the new financial year and the new school year in Japan.

Approximately 10 species grow wild in Japan, and many natural hybrids have been recognized. Horticultural varieties are mostly interspecific hybrids derived from *Cerasus itosakura* and *Cerasus speciosa*. The most representative cultivar, *Cerasus* × *yedoensis* ‘Somei-yoshino’, probably originated from the hybridization of cultivars derived from *C. pendula* and *C. lannesiana* (Nakamura et al., 2015).

Because many varieties are tall trees, the choice of varieties differs depending on their use. *Cerasus* × *yedoensis* (‘Somei-yoshino’) is a tall tree that is frequently planted in parks, public spaces and roadsides, but is not widely used as a cut flower, potted plant, or garden plant in private homes. *Cerasus* ‘Keio-zakura’ is the main cultivar used for cut flower production (Figure 7). This cultivar is more suitable because it produces many straight branches with few lateral branches, making it easy to harvest and adjust the branches as cut flowers.

Potted cherry trees are usually produced in a bonsai style in ceramic pots with a diameter of approximately 10 cm. In this application, varieties must be compact and well balanced with the size of the pot and have early flowering ability after cutting. *Cerasus* ‘Asahiyama’ and *Cerasus* ‘Gotenba’ are the main cultivars used to produce potted plants. As *Cerasus* ‘Asahiyama’ flowers at a very early age and with low tree height, it is widely used for potted plant production.

For planting in private homes, the limited size of most gardens makes it difficult to plant tall plants, including *Cerasus* × *yedoensis* ‘Somei-yoshino’. For this reason, *Cerasus* ‘Asahiyama’ and a few other low tree varieties are mostly planted in private gardens. However, cherry blossoms are not always popular as garden trees because of their height and perceived difficulty in pruning.

Figure 6. Example of planting with sasanqua.

Figure 7. Cut flowers of cherry blossom.

Figure 8. The famous tsutsusi azalea garden in Nezu shrine in Tokyo.

Figure 9. Various kinds of cultivars of *Vinca*.

Rhododendron

The genus *Rhododendron* of the family *Rhododendronaceae* includes various flowering trees such as azalea and rhododendron. Two varieties, known as tsutsusi azalea and satsuki azalea, are widely cultivated as garden plants in Japan.

Tsutsusi azalea is mainly composed of two variety groups: kurume azalea hybrids (*Rhododendron* × *obtusum* var. *sakamotoi*) and Hirado azalea (*Rhododendron* × *pulchrum*). Satsuki azalea consists of *Rhododendron indicum* and hybrids of related species. The Japanese name for the month of May is satsuki, thus reflecting the time of the year when the trees bloom.

When comparing tsutsusi azalea and satsuki azalea, tsutsusi azalea has larger flowers and leaves, and blooms in April, while satsuki azalea is generally smaller in height and blooms from May to June. Both tsutsusi azalea and satsuki azalea are often used as short hedges because they flower well, even with strong pruning (Figure 8). Both are hedging plants, with tsutsusi azalea used for hedges approximately 1 m high and satsuki azalea used for hedges of 50 cm or less.

Rose

Roses are very popular flowering plants in Japan where they are used for cut flowers, potted plants and garden plants. Many public and private rose gardens exist throughout the country. Breeding has been actively conducted in Japan, and many horticultural varieties are in circulation, including varieties introduced from overseas.

The mainstream varieties and seedling propagation methods differ depending on the intended purpose. For cut flower production, varieties are selected and bred for their high production, color, long stems and long-lasting flowers. Miniature roses are the most common type of potted rose because of their compact plant height. However, for garden plants, a wide variety of colors, shapes and fragrances are available to meet various consumer demands. However, in cultivating roses in Japan, given the high incidence of disease and loss of vigor due to high temperatures and humidity, varieties must be carefully selected with these attributes in mind.

With regard to propagation methods, this too is somewhat dependent on the intended use. For cut flower production in rockwool or other media, seedlings are produced from cuttings and simultaneous grafting using *R. odorata* as the rootstock. For potted flower production, propagation by cuttings is common from the standpoint of production efficiency. It also has an advantage in that any branches cut off to shape the plant prior to sale can also be used as cuttings. Seedlings for garden planting are mainly produced by grafting. In terms of adaptability to the growing environment, the most commonly used rootstock is *Rosa multiflora*, a wild rose species native to Japan.

In the production of roses for use as garden plants, rose crown gall disease is a problem in Japan. Crown gall disease causes a cancerous growth from the root to the stem wound near the base of plants through infection with *Rhizobium radiobacter*. Although extreme reductions in growth and death are

Figure 10. Various kinds of cultivars of pansy and Julian type *Primula*.

Figure 11. A personal garden planting white and purple cultivars of the ornamental kale "Habotan".

rare, crown gall disease is frowned upon by consumers. Therefore, seedling growers are required to control this disease to improve seedling quality.

Bedding plant production

The production of bedding plants in Japan is particularly problematic in the summer months, due to the high heat and humidity. Researchers have noted that *Vinca* and *Pentas* are the most suitable species for urban planting in summer due to their shade and drought tolerance as well as heat tolerance. *Vinca* has been bred in Japan since the 1960s. The color variation has increased to red, pink and purple, each with and without eye pattern (Figure 9). Additionally, many small flowering cultivars can be found today. *Pentas*, on the other hand, is a relatively new species introduced to Japan in the 1990s. It has since become very popular with consumers.

Petunia is the most popular bedding plant planted from spring to summer. Various kinds of cultivars possess disease resistance, double flowers and there is a wide variation in color and form. Even so, petunias are damaged by excessive heat and the high humidity in summer. More recently, cultivars possessing high tolerance to these environmental factors have appeared.

For winter planting, the most popular bedding plants for planting from autumn to spring are pansy and primrose. For both species, there is a rich variety of cultivars, by color, by form, and by size (Figure 10).

Ornamental kale is a group of cabbage (*Brassica oleracea*) cultivars, which have been bred in Japan to express purple or white colors in the leaves. These are called "Habotan" meaning "leafy peony". They are widely used in ornamental winter gardens because of their strong cold tolerance in Japan (Figure 11).

Various kinds of cultivars have been bred, including pale pink cultivars, vivid purple cultivars and black-like dark colors. Additionally for some cultivars, coloration appears only in the central part of the plant, or with the color density gradually changing from the central part to the margins. As for the morphology, some have deep fringed leaves while others have round leaves.

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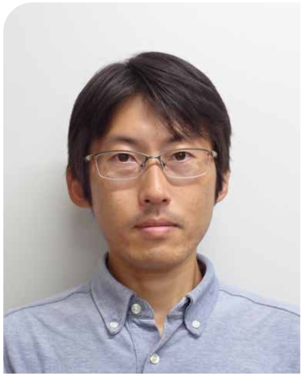

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› Plant tissue culture commercial production in Brazil

Patrícia Duarte de Oliveira Paiva, Renato Paiva, Edilson Paiva, Marcos Paiva and Luciano Vilela Paiva

In vitro propagation

In vitro plant propagation plays a crucial role in the expansion of agriculture. It enables the large-scale production of high-quality plants, including fruit, ornamental and forest tree species, commercial crops and vegetables. Tissue culture also serves as a promising alternative for producing plant-based metabolites, which are used in the food, cosmetic and pharmaceutical industries.

The advantages of in vitro propagation include phytosanitary quality, independence from seasonal variations, the ability to ensure a continuous supply of plants, genetic uniformity and a low environmental impact. However, there are also notable limitations, including high production costs, market pricing and regulatory challenges, as well as the potential for genetic mutations resulting from the use of high concentrations of growth regulators. The technology is more expensive than conventional propagation methods, and it is more labor-intensive and time-consuming, limiting its use to industrial and research laboratories.

Key milestones in the evolution of tissue culture

Gottlieb Haberlandt, a German physiologist, proposed the concept of in vitro cell culture and introduced the idea of totipotency in 1902. In his experiment, Haberlandt cultivated isolated single palisade cells from leaves in Knop's salt solution enriched with sucrose. After a month, the cells remained alive, and showed increased size and starch accumulation, although no cell division occurred (Haberlandt, 1902).

Subsequent important milestones followed, such as Hanning's successful embryo cultivation in 1904 (Hanning, 1904), further reinforcing the totipotency concept later confirmed by Vasil and Hildebrandt (1965).

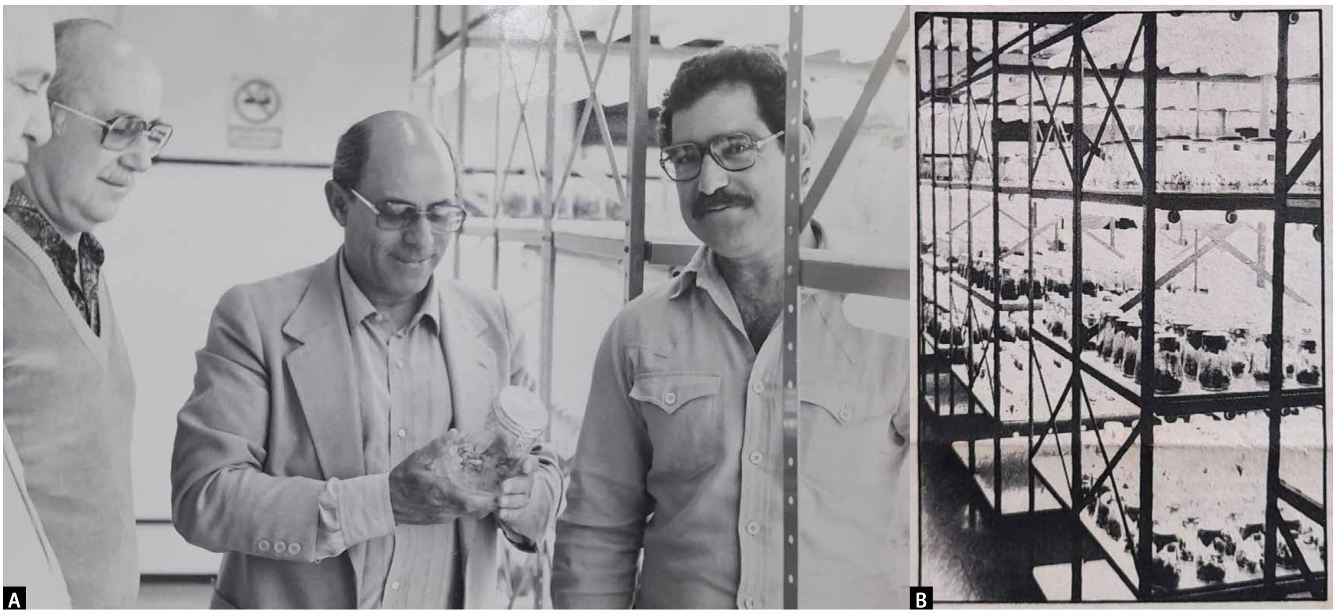
Over the years, research has significantly advanced tissue culture development. These include the identification of plant growth regulators and their roles (Went, 1926; White, 1943; Skoog and Miller, 1957), callus culture (Blumenthal and Meyer, 1924), and the formulation of culture media (White, 1943; Murashige and Skoog, 1962). Other breakthroughs include the production of virus-free plants (Morel, 1960), protoplast fusion (Power and Cocking, 1970), somatic embryogenesis (Reinert, 1958; Steward et al., 1958), cryopreservation (Reed, 2017), *Agrobacterium*-mediated plant transformation (Schell and Van Montagu, 1977), and more recently, the application of CRISPR technology (Liu et al., 2017).

Over the decades, these discoveries have highlighted the fundamental role of scientific research in advancing plant tissue culture. These developments have expanded the frontiers of scientific investigation and significantly boosted plantlet production.

First steps in Brazil

The first tissue culture work in Brazil was carried out in the 1950s by Dr. Agesilau Antonio Bitancourt of the Instituto Biológico de São Paulo (Torres and Caldas, 1990) and by Dr. Marico Meguro of the University of São Paulo. Dr. Meguro, in 1966, received training in Dr. Folke Skoog's laboratory at the University of Wisconsin, USA, but did not continue working in this field. As a researcher at the Instituto Biológico de São Paulo, Dr. Bitancourt focused primarily on phytopathology, especially in citrus (Rebouças, 2025).

One of the first effective tissue culture research teams in Brazil was established at ESALQ in 1971 by Dr. William Sharp and Dr. Linda Styer Caldas (Torres and Caldas, 1990). Simultaneously, in 1971, a Biotechnology Program was launched for research involving the in vitro culture of immature peach embryos at the Cascata Experimental Station – MAPA (currently the Agroecology Center). At that time, the station belonged to the former



■ Figure 1. A) Inauguration of the laboratory at the new headquarters of Embrapa in Pelotas, RS, Brazil. Left: Dr. Sérgio Sachs, Head of Research, and Dr. Edy de Araújo Fernandes, General Director; right: Dr. Márcio de Assis; center: unidentified. B) Tissue Culture Lab, Centro Nacional de Pesquisa Fruticultura Temperada (CNPFT) – EMBRAPA. Sources: A) unknown; B) Diário Popular, January 13, 1988.

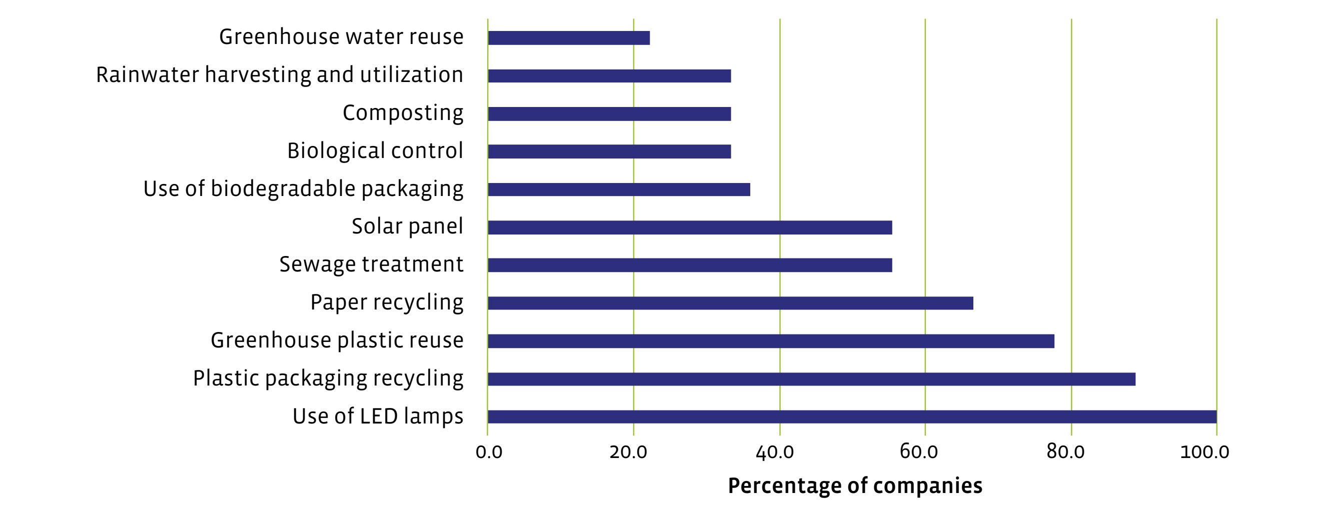


Figure 2. Sustainable practices adopted by tissue culture labs in Brazil.

IPEAS (Southern Agricultural Research Institute) and was later incorporated into the National Center for Research on Temperate Climate Fruit Crops (CNPFT). In 1983, with the inauguration of new facilities, meristem culture work was initiated, primarily aimed at producing virus-free plants. Among the highlighted projects was the production of virus-free seedlings of the 'Konvoy-Cascata' strawberry cultivar through thermotherapy. This project was coordinated by Dr. Márcio de Assis (Figure 1).

In the 1970s, several professionals were sent abroad through federal government programs to receive training in agronomic research techniques, including plant tissue culture. Upon their return to Brazil, they established laboratories at universities and research institutions across the country (Torres and Caldas, 1990). These laboratories became hubs for training undergraduate and graduate students, many of whom later contributed to the creation of commercial tissue culture laboratories in Brazil.

Perhaps the important milestone in the history of plant biotechnology in Brazil was the creation of the Center for Nuclear Energy in Agriculture (CENA) at the University of São Paulo – ESALQ in 1977. The initiative was led by Professor Otto Jesu Crocomo under the guidance of Professor William Sharp. It was one of the first institutional efforts to integrate advanced biotechnology research with public outreach and agricultural innovation. CENA was established to provide extension services to the community through cutting-edge research and development in plant and microorganism biotechnology. One of its main focuses was the production of disease-free seedlings, an essential step for improving agricultural productivity and phytosanitary quality. The Center developed protocols for the in vitro propagation of sugarcane, citrus, banana, strawberry and eucalyptus, playing a pioneering role in the application of tissue culture techniques in commercial agriculture.

Building on these advancements, in 1981, Professor Crocomo partnered with researcher Enio Oliveira to establish the Center for Agricultural Biotechnology (CEBTEC), an incubated company within the University of São Paulo. CEBTEC became one of the first Brazilian biotechnology enterprises dedicated to the large-scale production of clonal, pathogen-free plantlets, especially of sugarcane and citrus, which were crucial to the agro-industrial economy (Oliveira and Crocomo, 2017).

Emphasizing the importance of plant tissue culture, the Brazilian Association of Plant Tissue Culture (ABCTP) was established in 1983, in an initiative coordinated by Dr. Linda Styer Caldas, with Dr. Otto Jesu Crocomo elected as its first president. Dr. Crocomo coauthored several books, including *Applications of Tissue Culture in the Improvement of Coffee* (1977), and published numerous articles on tissue culture, including what is thought to be the first scientific article on tissue culture using *Coffea arabica*.

Although a National Meeting on Tissue Culture was held in 1983 during the Latin American Meeting on Tissue Culture, it was not until 2003 that the first Brazilian Congress on Tissue Culture was organized, bringing together a large number of researchers, students and companies.

Table 1. Plant tissue culture market size by crop groups.

Crop group	Species	Plant production per year
Agricultural	Sugarcane	50,300,000
	Grass	300,000
Vegetables	Pre-basic potato minitubers	600,000
	Strawberry mother plant	200,000
Fruit	Banana	12,000,000
	Papaya	1,000,000
Trees and palms	Palm trees	2,000,000
	Eucalyptus	1,500,000
Ornamental plant	Anturium	300,000
	Ornamental plants and others (ferns, caladium, orchids, japanese kiri, pineapple, etc.)	232,000
Total		**68,432,000***

* Plus additional amounts produced on demand.

Commercial production

The first commercial tissue culture laboratory for large-scale plant propagation was established in the 1950s, specifically to eliminate viruses from orchids (Thorpe, 2007; Kyte and Kleyn, 2010).

In Brazil, the first commercial laboratory was *Bioplanta Tecnologia de Plantas* (Bioplant Plant Technology), a biotechnology company of the Souza Cruz Group, in partnership with Native Plant Incorporated (NPI), located in Paulínia, in the state of Sao Paulo. It operated in the market from 1985 to 1990, focusing on the in vitro production of strawberry mother plants, potato mini-tubers, banana plantlets, grapevines and citrus, as well as vegetable seed breeding and production, and the multiplication of microorganisms (mycorrhizae). The company hired highly qualified professionals with international training, including Dr. Márcio de Assis (University of Wisconsin, Madison), Dr. Marcos Paiva (Purdue University, Indiana), Dr. Wilson Roberto Maluf (Purdue University, Indiana), Dr. Linda Styer Caldas (Ohio State University, Ohio), and Dr. Rui Caldas.

In 1990, British American Tobacco (BAT), the owner company of Souza Cruz, decided to shut down all of the group's global operations, except for tobacco research. Following the abrupt closure of Bioplanta, these professionals, with their expertise in tissue culture, pursued careers in either academia or the private sector.

Dr. Márcio de Assis and Dr. Marcos Paiva, former managers at Bioplanta, together with Otavio Carlos Armani, established Multiplanta in 1991. This private company has become one of the largest in the country. Today, Multiplanta Tecnologia Vegetal (https://multiplanta.com.br/) uses advanced plant biotechnology techniques, including aseptic plant cloning in laboratories and controlled acclimatization in greenhouses to supply the market with banana, papaya, strawberry mother plants, and seed potatoes. The company's creation and growth were driven by the intellectual capital of its founders and self-generated financial resources. With nationwide reach, the company maintains close ties with both the scientific and business communities.

In a similar manner, Dr. Edilson Paiva and Dr. Luciano Paiva established Biocell with the objective to clone and commercialize plants produced via in vitro tissue techniques. Today, Biocell (https://www.biocellclonagem.com.br/) employs 92 workers and produces more than 5 million plants annually, mainly bananas.

Another important laboratory that combines research with commercial production is ClonAgri Nurseries, owned by Jean-Marie Veauvy, which began operations in 1991 to propagate anthurium plants from leaf tissue. The company's methods were developed in collaboration with the Instituto Agronômico de Campinas (IAC), which at the time had an active anthurium breeding program. The conditions were relatively simple at that time: the leaves were covered with masking tape, wrapped in damp paper towels, and covered with two layers of newspaper, followed by aluminum foil. They were then placed in Styrofoam boxes and transported to the Clonagri laboratory. After one or two days in the refrigerator, the inoculation process of leaf segments (with veins) was carried out in solid culture media in test tubes.

Figure 3. Commercial laboratory in Brazil. Banana production in bioreactors (Biocell). Photo: Edilson Paiva.

After 3 to 6 months, calli and tissues in the multiplication phase were obtained. In this way, the laboratory was able to multiply all 60 IAC anthurium varieties and provide seedlings to producers, with a particular focus on the red-flowered 'Eidibel' cultivar.

This represented a major innovation in the national market, for until then, the most common method of seedling production was by clump division. Seedlings were then sent to smallholder producers at various sizes, with the primary focus on floriculture.

Profile of some commercial labs in Brazil

Despite the large number of laboratories in Brazil, most are affiliated with universities and research centers, where the primary focus is research. In contrast, there are private laboratories run by companies that focus on meeting the internal demand for seedling production. These laboratories generally produce sugarcane, citrus and ornamental plants.

Today, there are nine commercial tissue culture laboratories in Brazil, which collectively sell nearly 70 million seedlings per year. Among these companies, one has been in the market since 1965, three have been operating for over 30 years, four for 18 to 25 years, and only one is relatively new and was founded just three years ago. These companies are primarily located in the southeastern region of Brazil (89%), which is the country's most economically developed area.

Most of the owners hold a higher education degree in Agronomy or Biology, with many having completed postgraduate studies, including doctorates. The companies are typically managed by 1 to 4 partners.

The commercial products available in the Brazilian market primarily cater to the horticulture industry, with the focus on ornamentals, fruit, industrial crops and vegetables (Table 1).

Market overview and sustainability practices

More than 90% of the production is intended for the domestic market. Only one company exports around 5% of its production, mainly ornamental plants, but these sales are spo-

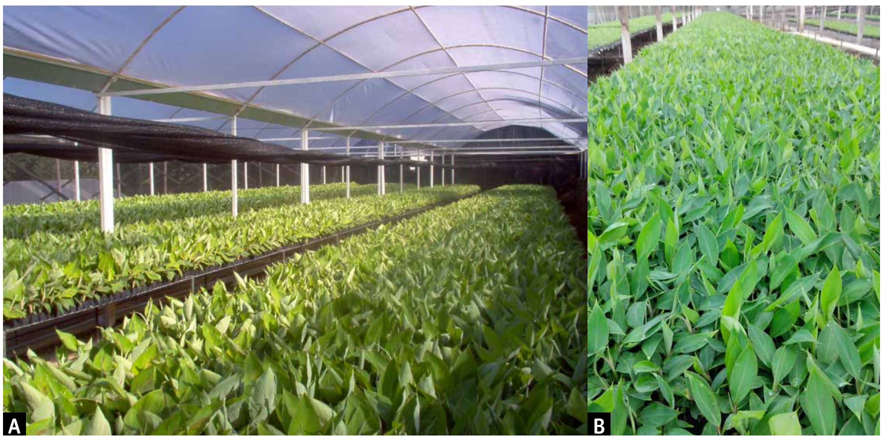


Figure 4. Commercial laboratory in Brazil. A) Acclimatization of banana plantlets (Biocell); B) Banana plantlets (Biocell). Photos: Edilson Paiva.

radic. However, most companies reported an interest in international markets. Only two indicated that they had no interest in international sales.

Losses during production and transport range from 3-10%, except for palm trees, where losses can exceed 30%.

With regard to physical infrastructure, the companies have laboratory spaces ranging from 50-1,600 m². The area dedicated to the maintenance of parent plants and acclimatization varies from 0.08-2,000 ha.

For those companies that provided financial information, annual revenues ranged from 20,000-3,660,000 USD.

Sustainable practices are essential for tissue culture laboratories to minimize their environmental impact and ensure their long-term commercial viability. The main sustainability practices adopted by the companies include the use of LED lights, recycling plastic packaging and reusing the plastic greenhouse covers (Figure 2).

Technical aspects of commercial tissue culture labs

From a technical standpoint, clonal propagation is the most widely used practice among commercial companies (89%). However, some companies also utilize other methods, including callogenesis (44%), in vitro seed germination (22%), embryogenesis (67%), mutation induction (11%), and viral cleaning (33%). Bioreactors are employed in two thirds of the companies (Figure 3).

The technologies adopted by commercial laboratories aim to increase production and reduce costs. One example is the bioreactor, which accelerates plant multiplication and growth while reducing space, energy and labor requirements. One company is already working on the development of a robotic system and another company, in addition to having automated systems, plans to use a robot for automated planting.

The beginning of tissue culture in Brazil was marked by professional training conducted in the USA. Those who underwent this training returned to Brazil as researchers in universities and research institutions. In addition to training new human resources in this field, they also contributed to the private sector by establishing commercial laboratories. Today, large national laboratories are well-equipped to meet the market demands, adopting cutting-edge technology for seedling production and incorporating important sustainability practices (Figure 4).

Acknowledgements

The authors would like to thank Jean-Marie Veauvy for the contribution providing the history of ClonAgri Nurseries, a topic for which there were no previous records. Thanks to Enio Tiago de Oliveira for sharing information through a book chapter he authored, which has limited availability in the country. Thanks also to Maria do Carmo Bassols Raseira, who provided exceptional assistance in researching historical documents from IPEAS. Last but not least, the authors would like to dedicate this work to Dr. Márcio de Assis in memoriam (1951-2024), who dedicated his whole professional life to the science of plant tissue culture research and commercial production. Dr. Márcio was one of the pioneers in introducing and establishing plant tissue culture technology in Brazil.

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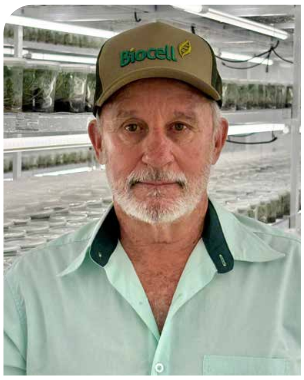

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XV International Protea Research Symposium and XX International Protea Association Conference

Division Ornamental Plants #ishs_dorn

The XV International Protea Research Symposium and XX International Protea Association Conference, held in Temecula, California, USA, from 30 March to 4 April 2025, were a huge success. Around 90 people from 9 countries on 5 continents registered for these meetings.

One of the key topics for discussion was new cultivar development and adaptation. Caroline O'Brien from Future Fynbos, South Africa, spoke about "A modified *Serruria* market: the introduction of new cultivars". Prior to 2022, only two *Serruria* varieties were named with the Dutch auction: one white, *Serruria florida*, and one pink, 'Sugar n Spice'. New cut flower cultivars have been released by Future Fynbos, each having a unique appearance and bloom patterns.

Ken Leonhardt from the University of Hawaii spoke about "Breeding *Leucospermum* hybrids for a warming planet". Ken discussed the use of the species *L. reflexum, L. formosum* and *L. grandiflorum* in breeding to impart warm temperature tolerance to their hybrids. The results of various cross combinations were discussed and illustrated.

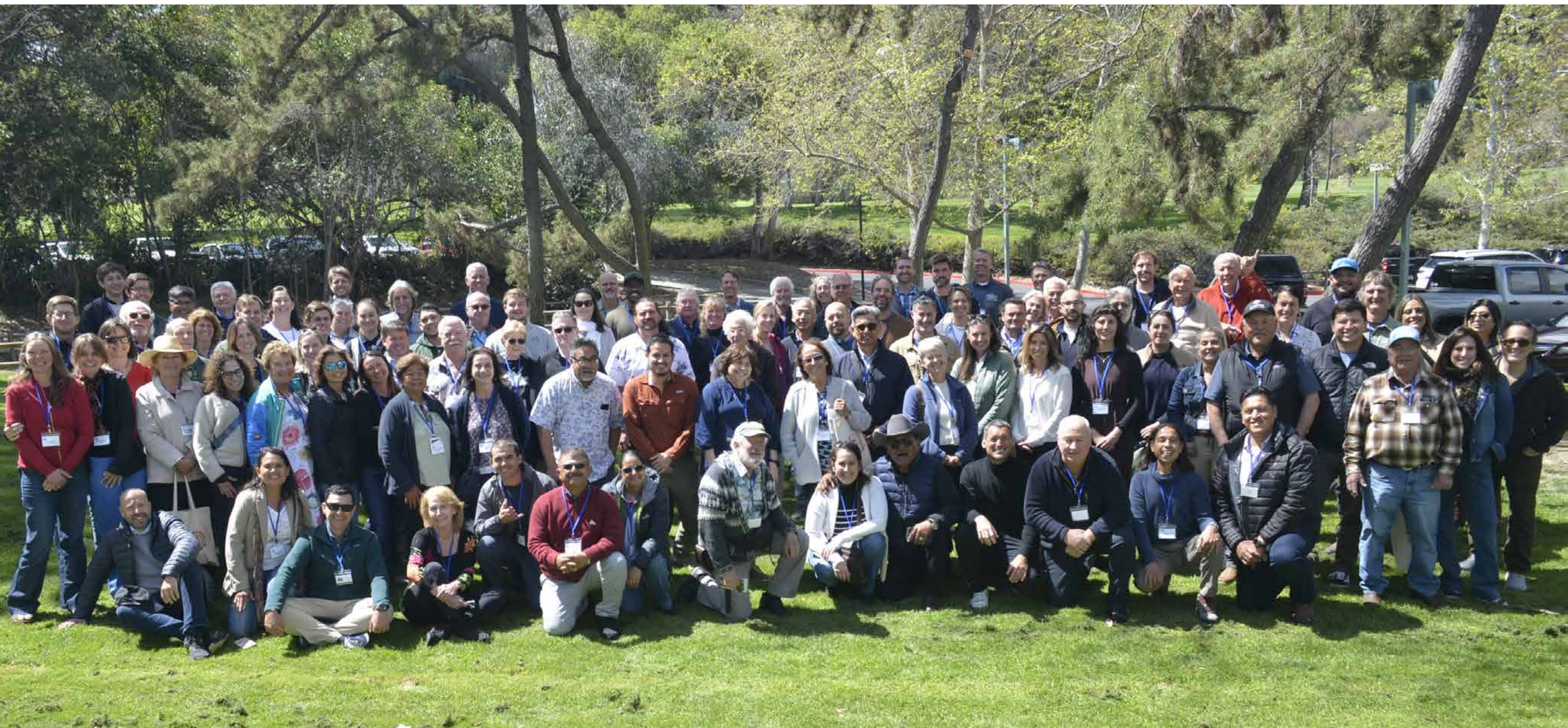
Also from the University of Hawaii, Russell Galanti spoke about "Low elevation tolerant protea trialing in Hawaii". *Leucospermum* are temperate climate plants and production in Hawaii is limited to elevations of 450 m or higher. However, agriculture land at lower elevations is not only more abundant but it's also cheaper, thus providing an opportunity for cultivating the new tropical varieties developed by the university. Russell reported on the fitness, health and yield of 14 new tropical hybrids that were planted at 150 m elevation on Oahu, Hawaii.

In a similar manner, Jayme Barton reported on "Growing proteas in a tropical environment". Jayme reported on the growth habit, disease and pest incidence, yield estimates and flower quality for several new tropical pincushion proteas that were being grown on a commercial farm on Oahu, Hawaii.

The other key topic discussed was the manipulation of flowering and other cultural practices. Keanu Martin from Stellenbosch, South Africa, spoke about "Manipulating flowering time in *Protea cynaroides* through plant growth regulators". With the majority of South Africa's *P. cynaroides* stems exported to Europe from September to November, this seasonal oversupply reduces the price per stem. Keanu shared some favorable results from his trials using 6-benzyladenine and uniconazole to imply that plant growth regulators could provide a promising tool for managing flowering times.

Naomi Naude, also from South Africa, talked about "Optimizing disbudding timing for extended harvest in Ayoba® *Leucospermum* cultivars". Disbudding is a strategy to optimize the production of *Leucospermum*. The cropping patterns of two Future Fynbos Ayoba® cultivars were compared to the industry benchmark, 'Succession'. Naomi demonstrated how disbudding schedules

› Participants of the symposium. Photo by Diana Roy.



› Drone at Kendall Farms. Photo by Alberto Ricordi.

could be utilized to align harvesting with market demands.

In a similar manner, Caroline O'Brien demonstrated how the pinching of Ayoba® *Leucadendron* cultivars could increase product value. The removal of apical meristems, known as pinching, is a technique widely applied across floricultural crops to encourage lateral shoot development. Pinching *Leucadendron* promotes branching and produces stems with multiple cones, which are highly desirable for spray varieties. The optimal timing for pinching specific cultivars for southern hemisphere conditions was reported.

Eugenie-Lien Louw, also from South Africa, spoke about "Optimizing micronutrient foliar applications in selected *Leucospermum* and *Protea* cultivars". Eugenie reported on her investigations into micronutrient formulations for enhancing crop productivity, focusing on zinc and manganese. The results suggest that foliar micronutrient management can be a viable approach to improve crop nutrient content.

Dennis Perry spoke about "Growing proteas in California". Marginal soils, water, drainage, salts and pH complicate the successful establishment and the longevity of plants in containers and in the field. Mitigation methods were discussed.

Three days of tours included Kendall Farms, Fallbrook, California. This visit was most impressive for its use of technology in the field and in the packing house.

During the ISHS business meeting, it was decided that the next International Protea Research Symposium and International Protea Association Conference would be held in South Africa in October 2028.

Ken Leonhardt

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› Robot at Altman Plants Nursery Tour. Photo by Alberto Ricordi.

› Dennis Perry and other attendees at Bandy Ranch Floral. Photo by Alberto Ricordi.

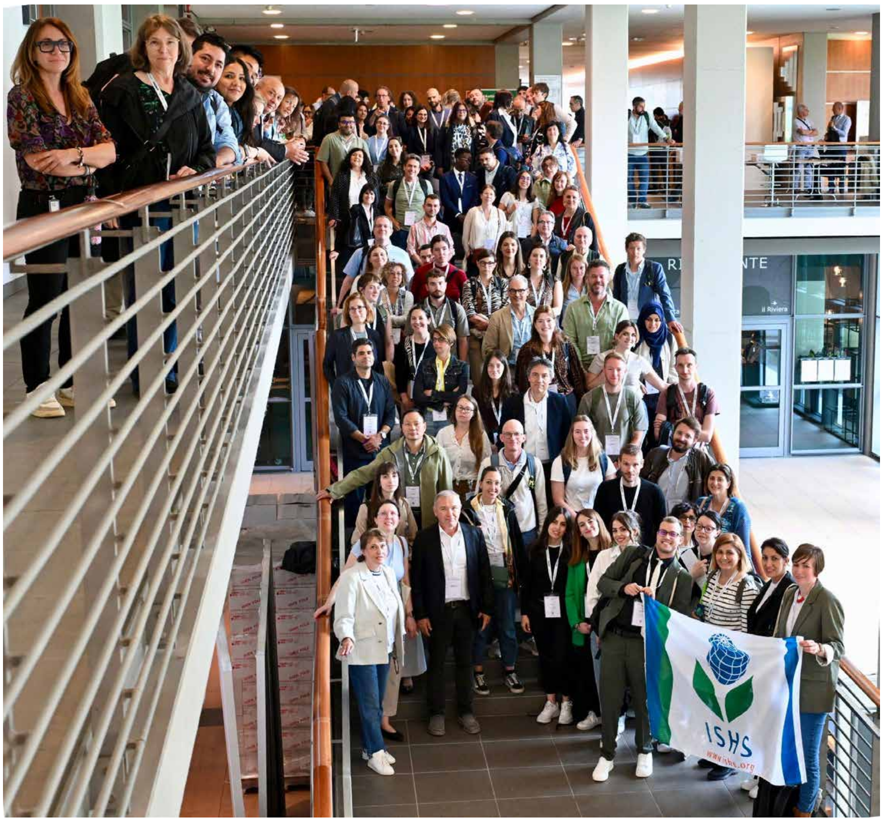
› International Symposium on Biotechnological Tools in Horticulture

Division Plant Genetic Resources and Biotechnology	#ishs_dbio
Division Horticulture for Development	#ishs_ddev
Division Ornamental Plants	#ishs_dorn
Division Temperate Tree Fruits	#ishs_dfru
Division Vegetables, Roots and Tubers	#ishs_dveg
Division Vine and Berry Fruits	#ishs_dvin

From May 6 to 8, 2025, the first International Symposium on Biotechnological Tools in Horticulture was successfully held in Rimini, Italy. The symposium attracted almost 200 attendees from 40 countries across six continents coming from both academia and the industrial sector. The program featured 9 keynote lectures, 62 oral presentations, and 73 posters, the latter presented as 3-min flash oral presentations.

A one-day pre-symposium technical tour was organized with visits to two Italian companies: Vitroplant Italia and Battistini Vivai, both of whom are considered leaders in plant micropropagation and nursery activities. During the tour, participants were able to observe the comprehensive management of the production chain, from in-vitro cultivation of various species, to open-field nurseries, marketing, and specific breeding and grafting programs.

The symposium was structured into parallel sessions, featuring a vast lineup of international experts who took turns exploring the latest biotechnological tools applied to horticulture. The discussions encompassed a broad range of themes, starting from plant in-vitro culture aspects, which serve as a critical foundation for plant propagation and genetic research. Experts delved into the latest developments in functional genomics highlighting how these studies enhance our understanding of gene function and regulation in plants. Moreover, various "omics" techniques, including genomics, transcriptomics, proteomics, and metabolomics, were explored for accurate plant genotyping and phenotyping. The symposium also addressed pioneering genomic techniques aimed at the genetic improvement of key agronomic species, such as those that enhance resistance to pests and diseases, or that increase yield



› Participants of the symposium

and nutritional value. Finally, the discussions considered the broader implications of biotechnology in horticulture, including its socio-economic impact, biosafety concerns, and the importance of public acceptance related to the use of biotechnology in the fruit and vegetable sector.

The topic on micropropagation and in-vitro plant approaches underscored this technique as a profitable avenue for large scale plant production, as well as a sector with strong potential for effectively integrating biotechnologies across various horticultural applications. In the session dedicated to new genomic techniques (NGTs), it was emphasized that, in many agronomic and ornamental species, it is now possible to develop genetically modified variants of elite cultivars without transgenic sequences, in accordance with current regulations. In this context, two invited speakers from the European Food Safety Authority (EFSA) shared scientific opinions in support of the European Commission, which has proposed

› The conveners Dr. Angela Ricci (second from left), Dr. Silvia Sabbadini (second from right) and Dr. Luca Capriotti (right) congratulate the Turkish delegation Dr. Sevinç Ateş (left), Prof. Dr. Ebru Kafkas (third from left) and Prof. Dr. Salih Kafkas (third from right) for being elected to organize the II International Symposium on Biotechnological Tools in Horticulture.

› Prof. Dr. Lorenzo Burgos, Chair of ISHS Working Group Genetic Transformation and Gene Editing, presenting the ISHS Young Minds Awards to A) Lucy Turnbull for the best oral presentation, and B) Irene Piunti for the best poster.

a new regulatory framework aimed at better accommodating the variety and specificity of plant products obtained through NGTs.
Completing the overview of innovative strategies, the session dedicated to RNA interference-based approaches showcased numerous examples in which this natural mechanism can enhance tolerance against pathogens and insects, even in the absence of genetic modifications. Molecules that activate this silencing signal (double-strand (ds) RNA) are now considered as new biopesticides, offering a specific and environmentally friendly strategy for the control of target organisms.
The biotechnological tools at the center of this symposium also included next-generation technologies that leverage artificial intelligence (AI) to enable growers to identify superior genotypes with greater efficiency and precision. New computational frameworks capable of integrating multi-omics data have also been developed to deeply understand complex biological pathways in horticultural crops.
Across the various sessions, the ten internationally renowned invited speakers contributed – together with all participants – to make the event a platform of high scientific value: Dr. Jan G. Schaart (Wageningen University and Research, Netherlands), Dr. Samir C. Debnath (Agriculture and Agri-Food Canada, St. John's, Canada), Prof. Massimo Delledonne (University of Verona, Italy), Prof. Hailing Jin (University of California, Riverside, USA), Dr. Davide Sosso (CSO & Co-founder, Heritable Agriculture, USA), Prof. Björn Usadel (Heinrich Heine University, Germany), Prof. Patrick J. Brown (University of California, Davis, USA), Prof. Jose Vallarino (University of Malaga, Spain), Dr. Antonio Fernandez Dumont and Dr. Reinhilde Schoonjans (EFSA, Italy).
The symposium was hosted by Macfrut 2025, an international trade event for professionals operating in the fruit and vegetable sector. These joint events provide a great opportunity to bring together academics and researchers with practitioners from industry.
The business meeting was presided over by Prof. Lorenzo Burgos, Chair of ISHS Working Group Genetic Transformation and Gene Editing, and Dr. Silvia Sabbadini, one of the conveners of the symposium together with Dr. Luca Capriotti and Dr. Angela Ricci. Prof. Burgos invited delegates from China, Turkey and the USA to present their proposals to host the next International Symposium on Biotechnological Tools in Horticulture. After a secret ballot, Turkey was chosen as the host country for the II International Symposium on Biotechnological Tools in Horticulture, to be held in 2028 or 2029. The convener will be Prof. Salih Kafkas from the University of Çukurova, Adana, Turkey. ISHS voting members also confirmed Prof. Dr. Lorenzo Burgos in his role as Chair of ISHS Working Group

› Participants to the Biotech school held at the Department of Agricultural, Food and Environmental Sciences, Marche Polytechnic University, Italy.

› Participants to the technical tour at the Italian company Vitroplant Italia, considered leader in horticultural plant micropropagation and nursery activities.

Genetic Transformation and Gene Editing and Dr. Sandra Correia in her role as Chair of ISHS Working Group Horticultural Biotechnology and Breeding.
Young researchers played a prominent role within this symposium, starting with the three conveners Dr. Silvia Sabbadini, Dr. Luca Capriotti and Dr. Angela Ricci. The ISHS Young Minds Awardees were selected by a committee of six distinguished international experts. During the closing ceremony, Prof. Lorenzo Burgos, as ISHS representative, presented Lucy Turnbull from the University of Edinburgh, United Kingdom, with the award for the best oral presentation “Building a molecular toolkit to understand *Begonia* evolution”, and Irene Piunti from Marche Polytechnic University, Italy, for the best poster entitled “Comparison of in vitro propagation methods and traditional stolon-based propagation of mother plants in five different strawberry cultivars”.
The organizers of the International Symposium on Biotechnological Tools in Horticulture were Dr. Silvia Sabbadini, Dr. Luca Capriotti, Dr. Angela Ricci, and Prof. Bruno Mezzetti from the Department of Agricultural, Food and Environmental Sciences, Marche Polytechnic University, Italy, together with Mr. Renzo Piraccini, Dr. Luigi Bianchi, and Dr. Gloria Teodorani from Macfrut 2025 staff.

Silvia Sabbadini, Luca Capriotti and Angela Ricci

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› XIV International Controlled and Modified Atmosphere Research Conference

Division Postharvest and Quality Assurance #ishs_dphq

The XIV International Controlled and Modified Atmosphere Research Conference (CAMA2025) took place from May 18-22, 2025, in Wenatchee, Washington, USA, under the aegis of the ISHS. It was convened by Dr. Carolina Torres (Washington State University, USA) and organized in collaboration with Dr. Rene Mogollon (Washington State University, USA), Dr. David Rudell (USDA-ARS Wenatchee, USA), and Dr. Ines Hanrahan (Washington Tree Fruit Research Commission, USA).
The conference brought together the global scientific community to exchange knowledge and to advance research in controlled and modified atmosphere storage systems for fruit and vegetables. It provided a platform for researchers, industry stakeholders and technical experts to share recent findings, discuss emerging technologies, and foster interdisciplinary collaboration. The conference addressed a wide range of topics, including dynamic and static atmosphere storage, fruit physiological responses, sensing and modeling tools, packaging innovations, and the integration of CA/MA strategies into supply chains and regulatory frameworks.
Highlights included advances in non-destructive, real-time sensing technologies for monitoring fruit quality, new insights into how

› Organizing Committee. From left to right: Ines Hanrahan, Carolina Torres (Convener), David Rudell, and Rene Mogollon.

different fruit species respond to dynamic storage environments, and the development of packaging solutions tailored to specific atmospheric conditions. These contributions provided valuable guidance for future research, offered practical implications for commercial storage practices, and supported the broader adoption of efficient and sustainable postharvest management systems.
The conference was attended by 137 participants from different parts of the world, including Belgium, Canada, Chile, Colombia, the United Kingdom, Czech Republic, Germany, France, Italy, India, Netherlands, New Zealand, Norway, South Africa, Spain, Switzerland, Thailand, and the United States. There were ten oral and two poster sessions, featuring 64 speakers. A series of insightful keynote presentations were delivered by leading experts in the field, each addressing critical topics related to postharvest storage technologies and fruit physiology. These included: Dr. Bart Nicolaï (KU Leuven, Belgium), who discussed recent advancements in dynamic storage technologies for pome fruit and their physiological implications; Dr. Pramod Mahajan (Leibniz Institute, Germany), who discussed the integration of sensor-based modeling into packaging and storage systems; Dr. Randolph Beaudry (Michigan State University, USA), who explored optimal storage atmospheres for blueberries; Dr. Christopher Watkins (Cornell University, USA), who examined the current challenges and future directions of DCA storage from a

U.S. perspective; and a concluding keynote by Dr. Bart Nicolaï, focusing on strategies to reduce energy consumption in long-term fruit storage.

To further enhance the scientific program, the conference concluded with two expert panel discussions, each bringing together diverse perspectives on key industry challenges. The first panel, moderated by Dr. Ines Hanrahan (Washington Tree Fruit Research Commission, USA), focused on new cultivars and novel fruit quality assessment. The panelists included Dr. Rob Blakey (Stemilt Growers, USA), Dr. Carolina Torres (Washington State University, USA), Dr. Dave Rudell (USDA-ARS, USA), and Dr. Chris Watkins (Cornell University, USA). The second panel addressed issues related to pear disorders and storage challenges. It was moderated by Dr. Carolina Torres (Washington State University, USA) and featured presentations by Séverine Gabioud Rebeaud (Agroscope, Switzerland), Dr. Dirk Köpcke (Lower Saxony Fruit Research Station Jork (OVA), Germany), Ann Schenk (Flanders Centre of Postharvest Technology, Belgium), and Shawn Cox (Peshastin Hi-Up Growers Inc.). Both panels offered cross-disciplinary insights into fruit physiology, disorder prevention, and supply chain management.

Attendees also had the opportunity to participate in one of three technical tours: 1) value-added fruit processing; 2) pome and stone fruit packing facilities; and 3) onion and potato packing and sorting.

› ISHS representative, Dr. Giancarlo Colelli (left), and CAMA2025 convener, Dr. Carolina Torres (right), presenting the ISHS Young Minds Award for the best poster to Sadat Amankona (second from left) and for the best oral presentation to Daniela Ramos (second from right).

In recognizing the outstanding contributions from students and early career researchers, ISHS presented two Young Minds Awards. The award for best oral presentation was granted to Daniela Ramos from Stellenbosch University, South Africa, for her talk titled "Dynamic controlled atmosphere – chlorophyll fluorescence (DCA-CF) and controlled atmosphere (CA) in long-term storage of 'Cripps' Pink' apples with special reference to internal browning". The award for best post-


› Conference participants

er presentation was given to Sadat Amankona from Washington State University, USA, for his work titled "The impact of DCA storage on fruit quality: a comparison between 'Gala' and 'Honeycrisp'".
During the ISHS Business meeting, Dr. Carolina Torres was elected as the new Chair of ISHS Working Group Controlled & Modified Atmosphere Storage of Horticultural Products. The XV International Controlled and Modified Atmosphere Research Conference (CAMA2029) will be held in the United Kingdom in 2029.

Isabel Ortega-Salazar and Carolina Torres

› Contact

Isabel Ortega-Salazar and Carolina Torres, Washington State University, Tree Fruit Research and Extension Center, 1100 North Western Ave., Wenatchee, WA 98801, USA, e-mail: i.ortega-salazar@wsu.edu and ctorres@wsu.edu

› Technical tour: participants visiting pome and stone fruit packing facilities.

› UrbanFarm2025 – International Student Challenge

Division Landscape and Urban Horticulture #ishs_durb

In a time where food production and food security are more crucial than ever, the International Student Challenge, UrbanFarm2025, brought together students from across the world to tackle these pressing issues through practical, small-scale innovation. Now in its 7th consecutive year, the competition, organised by the University of Bologna, Italy, and the IVL Swedish Environmental Research Institute, Sweden, once again united students from diverse disciplines and backgrounds in a vibrant exchange of ideas.
UrbanFarm2025 serves as a dynamic platform for young ambassadors to push the frontiers of sustainable agriculture. Participants are challenged to design real-world solutions that amalgamate the three pillars of sustainability: environmental, economic and social. It is more than a challenge – it's a call to action for the new changemakers.
This year's challenge unfolded at the KTH campus in Stockholm, Sweden, where the various teams were tasked with reimagining a currently underutilised, gravel-covered space on the edge of the campus. Their mission was to transform this underutilised space into a creative hub of social inclusion, creativity and innovation – a space for cutting-edge agricultural practices and forward-thinking socio-economic solutions. Working with an actual, scalable scenario, teams were challenged to turn bold ideas into feasible concepts.
UrbanFarm2025 officially kicked off on 21 February 2025, culminating in an exciting grand finale on 20 May 2025 at the KTH campus in Stockholm, hosted in KTH Innovation, a bright and creative space on-site. Seven teams took to the podium during the finale to present their concepts to a distinguished jury of experts, including Francesco Orsini and Giuseppina Pennisi from the University of Bologna, Italy, and Michael Martin from the IVL Swedish Environmental Research Institute. Over the course of three months, teams participated in a series of tasks, developed proposals, and engaged in collaborative activities. The final presentations, combined with ongoing performance evaluations, established the winners of what proved to be a closely contested and inspiring competition.
With a dense and exciting round of pitches from the different teams, the Team "Flourish" won the competition by bringing together a diverse group of talents: Ashish Pangeni (University of Bologna, Italy), Başak Ayyıldız (Gedze University, Turkey), Jamie Alves (Humboldt University of Berlin, Germany), Karen Mairead Naughton (University of Bologna,

› Team Flourish, winners of UrbanFarm2025, with the jury members. From left to right: Michael Martin (jury), Ashish Pangeni, Karen Mairead Naughton, Başak Ayyıldız, Giuseppina Pennisi (jury), Jamie Alves and Francesco Orsini (jury). Participating online: Yousef Ramadan.

› The participating students and organising committee at *Naturhistoriska Riksmuseet*, the Swedish Museum of Natural History.

Italy) and Yousef Ramadan (Cairo University, Egypt).

Team Flourish reimagined the underutilised, gravel lot as a sustainable urban farm designed to enhance mental well-being, foster social inclusion, and promote environmental stewardship. Inspired by Ulrich's Stress Recovery Theory, their concept featured a greenhouse made from upcycled glass, community gardens with native Swedish plants, and pollinator-friendly crops. Social elements included a collaborative art wall, an outdoor stage, study areas, and family-friendly zones. Incorporating systems for rainwater harvesting and composting, Flourish offered a replicable, resource-efficient model for transforming abandoned urban spaces into inclusive, restorative environments.

An honourable mention goes to all the teams as this year's contest overflowed with innovation and unique ideas. Every participant brought something new to the table, making the judging process especially challenging. During the whole week of the finale, participants were invited to take part in a variety of workshops and technical visits. This offered them hands-on exposure to real-world initiatives that encompass many principles they had defended in their projects.

To recognise their outstanding work, each member in the winning team, Flourish, received the prestigious ISHS Young Minds Award, which included an official certificate and a one-year subscription to the ISHS. This edition of UrbanFarm2025 reinforces the value of student engagement in addressing global challenges in food production. By encouraging cross-disciplinary and international collaboration, the competition continues to serve as a catalyst for innovative solutions. With its current momentum, the organisers are excited about the prospects of the UrbanFarm Challenge!

The UrbanFarm2025 organising committee would like to acknowledge Sofia Dahlbäck and Sara Norås from Akademiska Hus for their support, collaboration, and for providing this year's case study site, as well as the dedicated organising committee from University of Bologna-Alma Mater Studiorum and all the participating students – the true driving force behind this event.

› Contact

Agata Morelli, Riccardo Prandi and Giuseppina Pennisi, University of Bologna, Viale Fanin 44, 40127 Bologna, Italy, e-mail: agata.morelli2@unibo.it, riccardo.prandi@unibo.it and giuseppina.pennisi@unibo.it

› Snapshots of some of the activities over the week in Stockholm, Sweden. A) Students building garden beds at *Naturhistoriska Riksmuseet*, B) ice-breaking activity with students about urban agriculture at *Naturhistoriska Riksmuseet*, and C) workshop on circularity and resilience in agriculture at KTH.

From the Secretariat

New ISHS members

ISHS is pleased to welcome the following new members:

New Individual Members

Australia: Mr. Eyaya Gashaw Bekele, Ms. Amelie Beltakis, Ms. Zhangpan Hu, Dr. James Lawson; **Belgium:** Methodius Lahngong; **Brazil**: Ellen Rayssa Oliveira; **Cameroon:** Dr. Rosine Désirée Chougouo Knegne, Michel Tamo; **Canada:** Élisabeth Dube, Dr. Jazeem Wahab, Prof. Dr. Hannah Wittman; **Chile:** Mr. Patricio Espinoza; **China:** Ms. Xi Cao, Xizhi Cao, Prof. Dr. Longqing Chen, Tonghao Cui, Yang Hong, Prof. Xiang-Dong Li, Qi Liu, Mr. Yi Liu, Ms. Yuyang Mei, Dr. Zhenglin Qiao, Senbao Shi, Xiaohui Song, Rongrong Wu, Prof. Jin Yue; **Chinese Taipei:** Ms. Yu Ting Fu, Mr. Jhih Ting Hsiao, Ms. Yu-Ting Huang, Ms. Hsin-Yi Jen, Wen-Hao Li, Ms. Kai-Zhi Ma, Shu Hui Wu; **Costa Rica:** Paola Esquivel; **France:** Prof. Dr. Nadine Azas, Ms. Solene Besancon; **Germany:** Ruven Gierholz, Mr. Marcel Kuhnekath, Mr. Anton Peterson; **Greece:** Ms. Marina Chletsou, Assist. Prof. Aikaterini Gkoltsiou, Dimitrios Tsilianos; **India:** Mr. Faisaal Burza, Dr. Abinaya Chinnadurai; **Indonesia:** Ms. Yuni Kartika, Prof. Dr. Enny Sudarmonowati; **Italy:** Dr. Simona Baracco, Dr. Pasqualina Colasuonno, Dr. Domenico Crispo, Dr. Flavia de Benedetta, Emanuele Dichio, Dr. Donato Gerin, Dr. Francesco Loperfido, Ms. Fortuna Miele, Dr. Simone Nesi, Prof. Franco Nigro, Assoc. Prof. Domenico Rau, Dr. Aparna S Balan, Assist. Prof. Davide Scaccini, Dr. Laura Siracusa, Dr. Giorgia Tranchina, pasquale venerito; **Japan:** Mr. Junya Abe, Ms. Thidarat Chanpan, Mr. Pranav Deevi, Shiori Furukawa, Mr. Muhammad Gulzar, Nisa Vinka N. Hayati, Hinako Ide, Ms. Maya Imamura, Ai Kawai, Ms. Aika Kikuchi, Mr. Takumi Kishimoto, Ms. Ami Maruyama, Ms. Misaki Oga, Prof. Dr. Kae Sekine, Ms. Yui Shichi, Mr. Thu Win Si, Ms. Mao Sugiyama, Mr. Rintaro Suzuki, Mr. Takumi Taguchi, Mr. Kotaro Takahashi, Takumi Tojo, Prof. Dr. Hiroshi Wada, Ms. Hana Yamamoto, Ms. Fukino Yoshikawa; **Korea (Republic of):** Ms. Ji-Won Han, Dr. Chung Ho Ko, Ms. Nayeong Kwon, Ms. Ye-Ji Lee, Dr. Sooyeon Lim, Dr. Jai-Eok Park, Ms. Yeo Eun Yun; **Malaysia:** Dr. Siti Maslizah Abdul Rahman, Mr. Alif Ihsaan Akmal Shukri, Ms. Lorenta In Haryanto, Assoc. Prof. Nor Azlina Hasbullah; **Mauritius:** Mr. Gansam Boodram; **Mexico:** Mr. Diego Gamba, Dr. Jessica del Pilar Ramírez-Anaya; **Monaco:** Mr. Mitchell Jay NewDelman; **Morocco:** Mr. Moulay Youssef Loultiti, Kawtar Ziane; **Netherlands:** Frank Helm; **New Zealand:** Mr. Andrew Curtis; **Norway:** Ms. Sidsel Bckman; **Peru:** Mr. Mario Alegria Ayala, Emperatriz Huaytalla; **Philippines:** Mr. Elijah Juan Buenafe, Assist. Prof. Homer Deloso; **Romania:** Alexandra Martie; **Senegal:** Ms. Oulimata Sarr; **Serbia:** Assoc. Prof. Ivan Milenkovic; **South Africa:** Dr. Christiaan Daniels, Mr. Sihle Ngxabi, Mr. Sphelele Nzimakwe ; **Spain:** Dr. Carlos Alvarez Acosta, Dr. Lidia Aparicio Durán, Dr. José Manuel Cabezas Luque, Pedro Fernando Freire García, Dr. Omar Garcia-Tejera, Dr. Leontina Lipan, Mr. Osvaldo Renz; **Tanzania:** Dr. Zahra Majili; **Thailand:** Dr. Sukanya Aiamla-or, Mr. Apisit Cheukaw, Dr. Phuangphet Hemrattrakun, Dr. Phonkrit Maniwara, Assist. Prof. Pharima Phiriyangkul, Dr. Wissanee Pola, Ms. Katthareeya Sonthiya, Ms. Kawinthida Suksai, Dr. Nopparat Tatmala; **Turkey:** Assist. Prof. Turgut Alas, Prof. Dr. Mehmet Basbag, Mr. Osman Konut; **Ukraine:** Mr. Yurii Artimonov, Mr. Oleksandr Pakhno; **United Kingdom:** Dr. Guillaume Daverdin, Mr. Jason Hawkins-Row; **United States of America:** Nabin Adhikari, Dr. Veria Alvarado, Mark Bailey, Mr. Anthony Bogle, Janet Broome, Assoc. Prof. Zachary Brym, Bailey Burns, Ms. Gracie Carter, Ms. Sheri Crabtree, Joel Felix, Calvin Gardner, Lacey Gardner, Rebecca Garofano, Juan Gonzalez, Assoc. Prof. Zane Grabau, Dr. Courtney Hollender, Dr. Khalil Jahed, Lizhong Jiang, Dr. Melmaiee Kalpalatha, Dr. Colin Khoury, Hideka Kobayashi, Ms. Abigail Krent, Stacey Lee, Assist. Prof. Xiaoying Li, Jeremiah Lowe, William McMahan, Joanna Moine, Mr. Dinar Narvasa, Esther Chenxing Niu, Ms. Gladys Njeri, Paul Noren, Prof. Francesca Peduto Hand, Dr. Kathleen Rhoades, Raquel Salati, Assist. Prof. James Santiago, Hazel Schrader, Mr. Kshitij Shahi, Shankar Shakya, Mr. Matt Smith, Ms. Lauren Speicher, Mr. William Stevens, Jr, Stacy Swartz, Assoc. Prof. Virginia Sykes, Mr. Subas Thapa Magar, Prof. Pamela Weathers, Daniel Wells, Dr. Xi Xiong, Xinran Zheng.

In memoriam

Cosme Argerich (1955-2025)

Cosme Argerich, an internationally renowned researcher for his key contribution to the development of the Argentine processing tomato sector and his role within the World Processing Tomato Council (WPTC), was tragically killed in a car accident on June 27, 2025, near Mendoza at the age of seventy. Graduating as an agronomy engineer in 1978 at the National University of La Plata and gaining an MSc in Vegetable Crops at UC Davis in 1988, Cosme spent most of his working life at La Consulta INTA Research Station, in Mendoza, Argentina. He was a technical referent of INTA, committed to production innovation and technology transfer.

He began his work at INTA in 1979 in the Alto Valle Research Station. From 1989 until his retirement in 2020, he worked at La Consulta Research Station where he coordinated several regional, national and international projects related to processing tomatoes. He published many articles and book chapters and mentored many young scientists at undergraduate and graduate level in Argentina and globally. He organized more than thirty tomato field days with the tomato growers and scientists from all over the world. He made a great contribution in fields like soil management, transplant technologies, varietal selection, irrigation, integrated pest and disease management and mechanization, especially for harvesting.

He was the Chair of the ISHS Working Group Production of Vegetables for Processing

(2000-2008) and was Convener of the IV International Symposium on Processing Tomatoes in 1991, in Mendoza, Argentina; the XIV International Symposium on Processing Tomatoes at the XII World Processing Tomato Congress in 2016 in Santiago, Chile; and the XVI International Symposium on Processing Tomato at the XIV World Processing Tomato Congress in 2022, San Juan, Argentina. In addition, he organized the scientific program for symposia in Sacramento, USA (2000); Istanbul, Turkey (2002); Melbourne, Australia (2004); Tunis, Tunisia (2006); Toronto, Canada (2008); Beijing, China (2012); and Sirmione, Italy (2014). He also chaired the WPTC Research Commission from 2010 until 2023.

Despite being officially retired from INTA, he remained until his passing Tomate 2000's official representative on the board of the WPTC Research Commission, actively participating in meetings, facilitating the exchange of information and organizing congresses and symposia. He also worked closely with the California Tomato Research Institute.

He was a mentor for the Tomate 2000 association, a non-profit organization that managed to bring together tomato producers, industries, provincial governments, service providers and INTA technicians, articulating a common strategy for the development of the crop in Argentina. Tomate 2000 started in 1997. Tomate 2000 promoted the incorporation of technologies validated by public research. Over the past twenty years, productivity has increased from 30 t ha^{-1} to more than 90 t ha^{-1}, resulting in a gradual improvement in profitability. Even when he retired, he continued to act as an advisor to the entity that he helped to create.

He was member of both the International Society for Horticultural Science (ISHS) and the American Society for Horticultural Science (ASHS) since 1991, and the Argentine Association of Horticulture (ASAHO) since 1980.

The news of his death generated deep sadness. Cosme Argerich leaves a deep void in the Argentine and international tomato industry.

With his wife Monica, he was father of two daughters, María Inés and María Sol, and a son, Juan Ignacio, and a grandfather of six. We will miss Cosme deeply, not only for his professional contributions, but also for his friendship and humanity.

Claudio Galmarini, INTA, Argentina

› Calendar of ISHS events

For updates and more information, go to www.ishs.org › calendar of events. For a comprehensive list of meetings in each Division or Working Group use the "science" option from the website navigation menu.
To claim reduced registration for ISHS members, your personal membership number is required when registering - ensure your ISHS membership is current before **registering. When in doubt, sign in to your membership account and check/renew your membership status first: www.actahort.org or www.ishs.org**

Year 2025

- October 8-10, 2025, Arusha (Tanzania): **International Symposium on Artemisia**. Info: Mr. Arnaud Nouvion, 12 rue d'Ouessant, Paris, France. E-mail: anouvion@suricate.org or Assist. Prof. Emmanuel Sulle, AKU-ACER, TRPI Road, P O Box 499, Arusha, Tanzania. Phone: (255)742333575, E-mail: emmanuel.sulle@aku.edu Web: https://www.artemisia-symposium.com/
- October 13-16, 2025, Kalamata (Greece): **X International Symposium on New Ornamental Crops**. Info: Prof. Anastasios Darras, University of the Peloponnese, Antikalamos, Kalamata, 24100 None Kalamata, Greece. Phone: (0030)6974396588, E-mail: a.darras@uop.gr Web: https://newornamentals2025.uop.gr/
- October 14-18, 2025, Beijing (China): **V International Symposium on Plant Cryopreservation**. Info: Prof. Haiping Wang, 12 Zhongguancun Nandajie Haidian, Beijing, China. E-mail: wanghaiping@caas.cn Web: https://iot.cjhzcn.com:8284/
- October 20-24, 2025, Fort Myers, FL (United States of America): **IV International Symposium on Underutilized Plant Species**. Info: Dr. Timothy Motis, 17391 Durrance Road, North Fort Myers, FL 33917, United States of America. Phone: (1)2395433246, E-mail: tmotis@echonet.org or Dr. Carlos Iglesias Frascheri, 208 Weaver Mine Trail, Chapel Hill NC 27517, United States of America. Phone: (1)9843630400, E-mail: caiglesi@ncsu.edu or Dr. Arun Jani, California State University Monterey Bay, 100 Campus Center, Chapman Science Center, Seaside, CA 93955, United States of America. Phone: (1)831-582-4791, E-mail: ajani@csumb.edu Web: https://underutilizedplants25.org/
- November 5-7, 2025, Bogota (Colombia): **VI International Conference on Postharvest and Quality Management of Horticultural Products of Interest for Tropical Regions**. Info: Dr. Maria Soledad Hernandez, Amazonic Research Institute- Sinchi, Calle 20. No 5-44, Bogota, D.C, Colombia. Phone: (57)1 4442060, Fax: (57)12862418, E-mail: shernandez@sinchi.org.co or Ms. Luz Mantilla, Calle 20 No 5-44, Bogota 111211, Colombia. Phone: 576012442060, E-mail: luzmarmantilla@sinchi.org.co or Prof. Dr. Anibal Herrera, Calle 44 d 45-86 Apartamento 4-502, Bogotá D.C. 00000, National University of Colombia, Colombia. Phone: (57)3165000, Fax: (57)3165100, E-mail: aoherreraa@unal.edu.co E-mail symposium: postharvest_conference2025@sinchi.org.co Web: https://sixthicopocol.com.co/
- November 11-13, 2025, Shizuoka (Japan): **VI Asia Symposium on Quality Management in Postharvest Systems**. Info: Prof. Dr. Masaya Kato, Faculty of Agriculture, Shizuoka University, Ohya, Suruga, Shizuoka 422-8529, Japan. Phone: (81)54-238-4830, Fax: (81)54-237-3028, E-mail: kato.masaya@shizuoka.ac.jp E-mail symposium: asqp2025@gmail.com Web: https://asqp2025.org/

Year 2026

- January 18-23, 2026, Tatura, Victoria (Australia): **XI International Symposium on Irrigation of Horticultural Crops**. Info: Dr. Alessio Scalisi, Tatura SmartFarm, Agriculture Victoria Research, Dept Energy, Environment and Climate Action, 255 Ferguson Rd, Tatura, Victoria 3616, Australia. E-mail: alessio.scalisi@agriculture.vic.gov.au or Dr. Ian Goodwin, Tatura SmartFarm, Agriculture Victoria Research, Dept Energy, Environment and Climate Action, 255 Ferguson Rd, Tatura, Victoria 3616, Australia. Phone: (61)354831101, Fax: (61)358335299, E-mail: ian.goodwin@agriculture.vic.gov.au or Prof. Pablo J. Zarco-Tejada, SAFES, Faculty of Science, and, Department of Infrastructure Engineering, Faculty Engineering & Information Technol., Univ. Melbourne, Parkville, Victoria 3052, Australia. E-mail: pablo.zarco@unimelb.edu.au Web: https://www.irrigation2026.com.au/

- January 26-31, 2026, Kaohsiung City (Chinese Taipei): **VII International Jujube Symposium**. Info: Dr. Wen-Li Lee, Taiwan Agricultural Research Institute, No.530, Wenlong E.Rd., Fengshan Dist., 83052 Kaohsiung City, Chinese Taipei. Phone: (886)7310191, E-mail: wenlly@tari.gov.tw Web: https://jujube2026.com/
- March 15-20, 2026, Skukuza (South Africa): **IV International Symposium on Beverage Crops**. Info: Prof. Dr. Olaniyi Fawole, Postharvest & Agroprocesing Research Centre, Department of Botany & Plant Biotechnology, University of Johannesburg, APK Campus, South Africa. E-mail: olaniyif@uj.ac.za Web: https://bevcrops2026sa.carlamani.com/
- April 28-30, 2026, Abu Dhabi (United Arab Emirates): **VIII International Date Palm Conference**. Info: Prof. Dr. Abdelouahhab Zaid, Date Palm Research & Dev. Programme, UAE University, PO Box 81908, Al Ain, United Arab Emirates. Phone: (971)3 7832334, Fax: (971)3 7832472, E-mail: abdelouahhabz@diwan.gov.ae
- May 3-7, 2026, Lleida (Spain): **IX International Symposium on Almonds and Pistachios**. Info: Dr. Xavier Miarnau, IRTA-Fruitcentre, Parc Agrobiotech, Parc de Gardeny, 25003 Lleida, Spain. Phone: (34)675788825, E-mail: xavier.miarnau@irta.cat or Dr. Joaquim Bellvert Rios, Parc de Gardeny, IRTA Fruitcentre, 25003 Lleida Lleida, Spain. Phone: +34669012747, E-mail: joaquim.bellvert@irta.es Web: https://www.almondpistachio2026.com/
- NEW May 17-21, 2026, Chania, Crete (Greece): **X Southeastern and Eastern Europe Symposium on Vegetables and Potatoes**. Info: Dr. Dimitrios Savvas, Agricultural University of Athens, Laboratory of Vegetable Production, Iera Odos 75, 11855 Athens, Greece. Phone: (30)2105294510, Fax: (30)2105294504, E-mail: dsavvas@aua.gr or Assist. Prof. Georgia Ntatsi, Agricultural University of Athens, Laboratory of Vegetable Crops, Iera Odos 75, 11855 Athens, Greece. Phone: (30)2015294532, E-mail: ntatsi@aua.gr or Prof. Dr. Nazim Gruda, University of Bonn, INRES Horticultural Sciences, Auf dem Hügel 6, 53121 Bonn, Germany. E-mail: ngruda@uni-bonn.de Web: http://10seevp2026.maich.gr/
- May 18-22, 2026, Lofthus, Ullensvang (Norway): **VIII International Symposium on Postharvest Pathology**. Info: Dr. Jorunn Børve, Norwegian Institute of Bioeconomy Research, Ullensvang Research Center, Lofthus 5781, Norway. E-mail: jorunn.borve@nibio.no Web: https://nibio.pameldingssystem.no/isphpp2026
- NEW June 7-10, 2026, Monterey, CA (United States of America): **XVIII International Symposium on Processing Tomato - XVI World Processing Tomato Congress**. Info: Dr. Luca Sandei, SSICA, Tomato Department, Viale f.Tanara 31/a, 43121 Parma (PR), Italy. Phone: (39) 0521795257, Fax: (39) 0521771829, E-mail: luca.sandei@ssica.it or Zach Bagley, PO Box 2437, Woodland CA 95776, United States of America. Phone: (1)53-04059469, E-mail: zach@tomatonet.org or Dr. Brenna Aegerter, Univ of California Coop Extn., UCCE San Joaquin County, 2101 E Earhart Ave. Ste 200, Stockton, CA 95206, United States of America. E-mail: bjaegerter@ucanr.edu E-mail symposium: symposium@worldtomatocongress.com Web: https://www.16thworldtomatocongress.com/
- June 22-24, 2026, Iksan, Jeonbuk (Korea (Republic of)): **XVI International Asparagus Symposium**. Info: Prof. Dr. Yang Gyu Ku, Department of Horticulture Industry, College of Agriculture and Food Sciences, Wonkwang University, Iksan-city, Korea (Republic of). Phone: (82)638506672, Fax: (82)638507308, E-mail: ygku35@wku.ac.kr or Prof. Dr. Young Yeol Cho, Collage of Applied Life Sciences, Department of Horticultural Science, Jeju National University, Jeju, Korea (Republic of). Phone: (82)647543325, Fax: (82)647254905, E-mail: yycho@jejunu.ac.kr or Prof. Dr. Jong Hyang Bae, Department of Horticulture Industry, College of Agriculture and Food Sciences, Wonkwang University, Iksan-city, Korea (Republic of). Phone: (82)638506671, Fax: (82)638507308, E-mail: bae@wku.ac.kr or Prof. Dr. Young Rog Yeoung, Department of Plant Science, College of Life Science, GangneungWoju National University, Gangwon-Do, Korea (Republic of). Phone: (82)336402356, Fax: (82)336402909, E-mail: yryeoung@gwnu.ac.kr E-mail symposium: secretariat@ias2026.org
- August 23-28, 2026, Kyoto (Japan): **XXXII International Horticultural Congress: IHC2026**. Info: Prof. Dr. Ryutaro Tao, Lab. Pomology, Fac. Agric., Kyoto University, Kitashirakawa Oiwake-cho, Sakyo-ku Kyoto 606-8502, Japan. Phone: (81)757536053, Fax: (81)757536497, E-mail: tao.ryutaro.8c@kyoto-u.ac.jp E-mail symposium: ihc2026@convention.co.jp Web: https://www.ihc2026.org/

Symposia at IHC2026

- August 23-28, 2026, Kyoto (Japan): **International Symposium on Horticultural Genetic Resources and their Usefulness for Breeding**. Info: Dr. Sandra Correia, InnovPlantProtect, Estrada de Gil Vaz, 7350-478 Elvas, Portugal. E-mail: sandra.correia@iplantprotect.pt or Dr. Nobuko Mase, Citrus Research Station, Institute of Fruit, Tree and Tea Science, NARO, 485-6 Okitsunaka-cho, Shimizu, Shizuoka City, Shizuoka 424-0292, Japan. E-mail: mase.nobuko909@naro.go.jp or Dr. Yoichi Kawazu, Inst. of Vegetable & Floriculture Sci. NARO, 360 Ano, Tsu, Mie, Japan. E-mail: ykawazu@affrc.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s01/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Challenges and Perspectives on Innovative Technologies for Breeding of Horticultural Crops**. Info: Prof. Byoung-Cheorl Kang, Seoul Natl. Univ., San 56-1, Sillim 9-dong, Gwanak-gu, Seoul 151-742, Korea (Republic of). E-mail: bk54@snu.ac.kr or Prof. Isobe Sachiko, University of Tokyo, Bunkyo 1-1-1, Yayoi, Tokyo, 113-8657, Japan. E-mail: sisobe@g.ecc.u-tokyo.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s02/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Innovative Technologies and Production Strategies for Smart Greenhouse**. Info: Prof. In-Bok Lee, Lab.of Aero-Environmental Engineering, College of Agric. and Life Science, Seoul National University, San 56-1, Silim-dong, Gwanak-Gu, Seoul, Korea (Republic of). E-mail: iblee@snu.ac.kr or Dr. Tadahisa Higashide, National Agric. & Food Res. Organization, 3-1-1, Kannondai, Tsukuba, Ibaraki, 305-8519, Japan. E-mail: ton@affrc.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s03/
- August 23-28, 2026, Kyoto (Japan): **II International Symposium on Advances in Vertical Farming**. Info: Prof. Dr. Qichang Yang, Institute of Urban Agriculture, CAAS, No. 36, Lazidong Street, Shuangliu District, Chengdu, Sichuan, China. E-mail: yangqichang@caas.cn or Prof. Dr. Eiji Goto, Graduate School of Hort.,Chiba University, 648 Matsudo, Matsudo, Chiba 271-8510, Japan. E-mail: goto@faculty.chiba-u.jp or Prof. Dr. Naoya Fukuda, Inst. Life Environ. Sci., T-PIRC, University of Tsukuba, Tennodai 1-1-1, Tsukuba city, Japan. E-mail: fukuda.naoya.ka@u.tsukuba.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s04/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Sustainable Plant Production in Greenhouse Horticulture and Protected Cultivation**. Info: Dr. Silke Hemming, Wageningen University & Research, Business Unit Greenhouse Horticulture, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. E-mail: silke.hemming@wu r.nl or Dr. Yasunaga Iwasaki, 2060-1 Kurokawa Asao ward, Kawasaki city 2150035, Meiji University, Faculty of Agriculture, Japan. E-mail: iwasakiy@meiji.ac.jp E-mail symposium:

p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s05/

- August 23-28, 2026, Kyoto (Japan): **International Symposium on Modeling and Digital Approaches to Explore the Diversity of Crop Physiology and Management in Field Conditions**. Info: Dr. Evelyne Costes, INRA UMR AGAP, Avenue Agropolie, 34398 Montpellier Cedex 5, France. E-mail: evelyne.costes@inrae.fr or Takayoshi Yamane, 2-1 Fujimoto, Tsukuba 3058605, Japan. E-mail: yamane.takayoshi156@naro.go.jp or Dr. Koji Sugahara, 3-1-1 Kannondai, Tsukuba 3058519, Japan. E-mail: sugahara.koji783@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s06/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Developmental and Molecular Responses of Horticultural Plants to Abiotic Stress, including Temperature**. Info: Dr. Erika Varkonyi-Gasic, PFR, Private Bag 92169, Auckland mail Centre, 1142 Auckland, New Zealand. E-mail: erika.varkonyi-gasic@plantandfood.co.nz or Prof. Dr. Nobuhiro Kotoda, Fruit Science lab, Saga University, 1 Honjo-machi, Saga 840-8502, Japan. E-mail: koto@cc.saga-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s07/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Advances in Postharvest Biology and Technology of Horticultural Crops**. Info: Assoc. Prof. Kietsuda Luengwilai, Dept. Horticulture, Fac. Agriculture at Kamphang Saen, Kasetsart University, Kamphang Saen campus, Kamphang Saen 73140, Thailand. E-mail: kietsuda.l@ku.ac.th or Assoc. Prof. Eriko Yasunaga, 3-5-8 Saiwai-cho, Tokyo University of Agriculture and Technol, Fuchu 183-8509, Japan. E-mail: erikoy@go.tuat.ac.jp or Dr. Yasuo Suzuki, Faculty of Agriculture, Meijo University, Shiogamaguchi 1-501, Tenpaku-ku, Nagoya 468-8502, Japan. E-mail: yasuosuzuki@meijo-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s08/
- August 23-28, 2026, Kyoto (Japan): **XI International Symposium on Human Health Effects of Fruits and Vegetables - FAVHEALTH2026**. Info: Prof. Mariusz Piskula, Wadowskiego 15, 10-761 Olsztyn, Poland. E-mail: m.piskula@pan.olsztyn.pl or Prof. Kaeko Murota, 1060 Nisikawatsu-cho, Matsue 690-8504, Shimane, Japan. E-mail: murota@life.shimane-u.ac.jp or Dr. Kentaro Matsumiya, Graduate School of Agriculture, Kyoto University, Kitashirakawa-Oiwakecho, Sakyo, Kyoto 606-8502, Japan. E-mail: matsumiya.kentaro.6w@kyoto-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s09/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Medicinal, Aromatic Plants and Natural Colorants – incl. ISSBT2026**. Info: Prof. Mahmoud A. Sharafeldin, National Research Centre, Egypt. E-mail: sharafeldin99@yahoo.com or Dr. Po-An Chen, No. 3, Aly. 35, Ln. 191, Jiannan Rd., Pingtung City, Pingtung County 900, Taiwan, 900 Pingtung, Chinese Taipei. E-mail: chenpoan@mail.atri.org.tw or Assist. Prof. Ryosuke Munakata, Lab. Plant Gene Expression, RISH, Kyoto Uni, Uji, Japan. E-mail: munakata.ryosuke.3z@kyoto-u.ac.jp or Assist. Prof. Toshiyuki Waki, Aramaki Aza Aoba, Aoba-ku, Tohoku University, Sendai 9808579, Japan. E-mail: waki@tohoku.ac.jp E-mailsymposium:p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s10/
- August 23-28, 2026, Kyoto (Japan): **XVII International People Plant Symposium and IV International Symposium on Horticultural Therapies (HortTherapy2026)**. Info: Prof. Dr. Sin-Ae Park, Konkuk University, 225 Life and Environment Science building, 05029 Seoul, Korea (Republic of). E-mail: sapark42@konkuk.ac.kr or Takuya Kenmochi, Awaji Campus, University of Hyogo, 954-2 Nojimatokiwa, Awaji 656-1726, Japan. E-mail: takuya_kenmochi@awaji.ac.jp or Assoc. Prof. Fumie Tazaki, Awaji campus, University of Hyogo, 954-2 Nojimatokiwa, Awaji 656-1726, Japan. E-mail: taz23a@sky.plala.or.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s11/
- August 23-28, 2026, Kyoto (Japan): **II International Symposium on Urban Horticulture for Sustainable Food Security: Toward Food-Secure Cities (UrbanFood2026)**. Info: Dr. Giuseppina Pennisi, University of Bologna, Viale Giuseppe Fanin 44, 40127 Bologna, Italy. E-mail: giuseppina.pennisi@unibo.it or Mr. Masakazu Yamada, 1-1 Owashi, Tukuba 3058686, Japan. E-mail: myama42@affrc.go.jp or Dr. Sayuri Teramoto, University of the Ryukyus, 1 Senbaru, Nishihara, Okinawa, 9030213, Japan. E-mail: teramoto@cs.u-ryukyu.ac.jp or Yasuhiko Koike, Tokyo University of Agriculture, 1737 Funako Atsugi, Kanagawa 243-0034, Japan. Phone: (81)462706527, E-mail: koike@nodai.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s12/
- August 23-28, 2026, Kyoto (Japan): **IV International Symposium on Greener Cities: Re-imagining Urban Landscapes (GreenCities2026)**. Info: Prof. Dr. Luis Pérez-Urrestarazu, Agro-Forestry Engineering, Universidad de Sevilla, ETSIA Ctra. Utrera km.1, 41013 Sevilla, Spain. E-mail: lperez@us.es or Assoc. Prof. Tomoko Takeuchi, 648 Matsudo, Matsudo-shi, Chiba, 271-8510, Japan. E-mail: tomoko_takeuchi@chiba-u.jp or Assoc. Prof. Shoko Hikosaka, 648 Matsudo, Matsudo city 271-8510, Japan. E-mail: s-hikosaka@faculty.chiba-u.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s13/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Evaluating the Impact and Scaling of Innovations for Sustainable Horticulture**. Info: Dr. Melinda Knuth, NC State University, 2721 Sullivan Drive, Campus Box 7212, Raleigh, NC 27695, United States of America. E-mail: mjknuth@ncsu.edu or Prof. Dr. Shusuke Matsushita, Kitashirakawa Oiwake-cho, Sakyo-ku, Kyoto, Japan. E-mail: matsushita.shusuke.7z@kyoto-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s14/
- August 23-28, 2026, Kyoto (Japan): **II International Symposium on Agroecology and Systems Approaches for Sustainable and Resilient Horticultural Production**. Info: Prof. Dr. Maria Claudia Dussi, Universidad Nacional del Comahue, Facultad de Ciencias Agrarias, CC 85 (8303) Cinco Saltos, Rio Negro-Patagonia, Argentina. E-mail: mcdussi@yahoo.com or Prof. Rachel Bezner Kerr, 262 Warren Hall, Department of Global Development, Cornell University, Ithaca, NY 14853, United States of America. E-mail: rbeznerkerr@cornell.edu or Prof. Dr. Rie Miyaura, 1-1-1, Sakuragaoka, Setagaya 156-8502, Japan. E-mail: mia@nodai.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s15/
- August 23-28, 2026, Kyoto (Japan): **II International Symposium on Innovations in Ornamentals: From Breeding to Market**. Info: Prof. Junping Gao, China Agricultural University, Beijing, 100193, China. E-mail: gaojp@cau.edu.cn or Dr. Kenichi Shibuya, 2-1 Fujimoto, Tsukuba 305-0852, Japan. E-mail: shibuya.kenichi573@naro.go.jp or Dr. Masafumi Yagi, Ins. of Vegetable and Floriculture Science, NARO, 2-1 Fujimoto, Tsukuba, Japan. E-mail: yagi.masafumi967@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s16/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Innovative Use of Diverse Traits (Color, Shape and Fragrance) in Ornamentals**. Info: Prof. Dr. Zhanao Deng, University of

Florida, IFAS, Gulf Coast Research and Education Center, 14625 County Road 672, Wimauma, FL 33598, United States of America. E-mail: zdeng@ufl.edu or Dr. Ayumi Deguchi, 648, Matsudo, Matsudo-shi 271-8510, Japan. E-mail: deguchia@chiba-u.jp or Prof. Dr. Munetaka Hosokawa, Nakamachi, Nara-shi, Nara 631-0052, Japan. E-mail: mune@nara.kindai.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org /symposia/s17/

- August 23-28, 2026, Kyoto (Japan): **International Symposium on Vegetable Breeding for Sustainable Field and Greenhouse Production through Modern Selection Techniques and Molecular Tools (BreedVegs2026)**. Info: Prof. Dr. Yuling Bai, WUR, Drovendaalsesteeg 1, 6700 AJ Wageningen, Netherlands. E-mail: bai.yuling@wur.nl or Dr. Pasquale Tripodi, Via Cavalleggeri 25, 84098 Pontecagnano Faiano, Italy. E-mail: pasquale.tripodi@crea.gov.it or Prof. Dr. Masayoshi Shigyo, Faculty of Agriculture, Yamaguchi University, Yoshida 1677-1, Yamaguchi 753-8515, Japan. E-mail: shigyo@yamaguchi-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s18/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Diversification of Vegetable Production and New Growing Techniques for Sustainable Farming Systems (GreenVegs2026)**. Info: Assoc. Prof. Francesco Di Gioia, The Pennsylvania State University, Shortlidge Road, Tyson Building 207, University Park PA 16802, United States of America. E-mail: fxd92@psu.edu or Dr. Megumu Takahashi, 3-1-1, Kannondai, Tsukuba 3058519, Japan. E-mail: takahashi.megumu000@naro.go.jp or Dr. Fumio Sato, Kannondai 3-1-1, Tukuba 3058519, Japan. E-mail: sato.fumio525@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s19/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Berries: New Tools for Crop Improvement**. Info: Assoc. Prof. Lisa DeVetter, WSU, 16650 Washington 536, Mount Vernon, WA 98273, United States of America. E-mail: lisa.devetter@wsu.edu or Dr. Sarah Pilkington, 120 Mt Albert Road, Mt Albert, 1025 Auckland, New Zealand. E-mail: sarah.pilkington@plantandfood.co.nz or Dr. Takeshi Kurokura, 350 Mine, Faculty of Agriculture, University of Utsunomiya, Utsunomiya 321-8505, Japan. E-mail: kurokura@cc.utsunomiya-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s20/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Advances in Grapevine Genetics and Physiology: Innovation and Adaptation for the Next-Generation Resilient Viticulture**. Info: Prof. Giovanni Battista Tornielli, DAFNAE, University of Padova, Viale dell'Università, 16, 35020 Legnaro (PD), Italy. E-mail: giovannibattista.tornielli@unipd.it or Prof. Dr. Jinggui Fang, No. 666, Binjiang Avenue, Jiangbei New Area, Nanjing, Jiangsu, P.R.China, 211800, China. E-mail: fanggg@njau.edu.cn or Dr. Akifumi Azuma, Institute of Fruit Tree and Tea Science, NARO, Akitsu Mitsu 301-2, Higashi-Hiroshima Hiroshima 739-2494, Japan. E-mail: azuma.akifumi128@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s21/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Sustainable Production Systems in Temperate Tree Crops**. Info: Prof. George Manganaris, Anexartisias 57, PAREAS Building, P.O. Box 50329, 3603 Lemesos, Cyprus. E-mail: george.manganaris@cut.ac.cy or Hideki Murayama, Faculty of Agriculture, Yamagata University, 1-23 Wakabamachi Tsuruoka, Yamagata 997-8555, Japan. E-mail: mhideki@tds1.tr.yamagata-u.ac.jp or Prof. Dr. Takuya Tetsumura, Department of Agriculture, Faculty of Agriculture, University of Miyazaki, 889-2192, Japan. E-mail: tetsumur@cc.miyazaki-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s22/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Application of Genetics and Breeding Approaches to Improve Temperate Tree Crops**. Info: Prof. Dr. Fabrizio Costa, Via Mach 1, 38098 San Michele all"Adige, Trento, Italy. E-mail: fabrizio.costa@unitn.it or Dr. Atsushi Kono, 2-1, Fujimoto, Tsukuba, Ibaraki 305-8605, Japan. E-mail: kono.atsushi993@naro.go.jp or Dr. Miyuki Kunihisa, Fujimoto 2-1, Tsukuba, Japan. E-mail: kunihisa.miyuki700@naro.go.jp or Dr. Norio Takada, Institute of FruitTree and TeaScience, NARO, Fujimoto 1-2, Tsukuba, Ibaraki 305-8606, Japan. Phone: (81)298386464, E-mail: takada.norio513@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s23/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Bridging Science and Practice for Tropical and Subtropical Fruits and Nuts**. Info: Prof. Dr. Zora Singh, Edith Cowan University, Horticulture, School of Science, 270 Joondalup Drive, Joondalup 6027, Western Australia, Australia. E-mail: z.singh@ecu.edu.au or Assoc. Prof. Shu-Yen Lin, 1, 4th sec., Roosevelt Road, Da-an district, Dept. of Horticulture, National Taiwan University, Chinese Taipei. E-mail: sylin@ntu.edu.tw or Dr. Naoko Kozai, Kagoshima University, Korimoto 1-21-24, Kagoshima, Kagoshima 890-0065, Japan. E-mail: nkozai@agri.kagoshima-u.ac.jp or Dr. Shingo Goto, 2-1 Fujimoto, Tsukuba, Ibaraki 305-8605, Japan. Phone: (81)29-838-6474, E-mail: goto.shingo184@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s24/
- August 23-28, 2026, Kyoto (Japan): **XIII International Symposium on Banana: Exploring Banana Diversity for Improved Livelihoods**. Info: Dr. Sebastien Carpentier, Bioversity International, Willem de Croylaan 42 - bus 2455, 3001 Heverlee, Belgium. E-mail: sebastien.carpentier@biw.kuleuven.be or Assoc. Prof. Yasuaki Sato, Global Humanities and Social Sciences, Nagasaki University, 1-14 Bunkyo, Nagasaki 852-8521, Japan. E-mail: y-sato@nagasaki-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s25/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Recent Advances in Horticulture in East Asia, Southeast Asia and the Pacific**. Info: Prof. Dr. Roderick A. Drew, Griffith Sciences, Griffith University, Kessels Road, Nathan, QLD 4111, Australia. E-mail: roderick.drew646@gmail.com or Prof. Dr. Zhen-Hai Han, Institute for Horticultural Plants, China Agricultural University, No. 2 Yuanmingyuanxilu, 100193 Beijing, China. E-mail: rschan@cau.edu.cn or Dr. Sota Koeda, Lab. Horticultural Science, Kindai University, 3327-204 Nara 631-8505, Japan. E-mail: 818sota@nara.kindai.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s26/
- August 23-28, 2026, Kyoto (Japan): **International Symposium on Innovation in Horticulture, via Fundamental Science on Reproductive Biology of Annuals and Perennials**. Info: Prof. Avi Sadka, ARO, The Volcani Center, Department of Fruit Trees Sciences, 68 HaMaccabim Rd., P.O. Box 15159, Rishon LeZion 7528809, Israel. E-mail: vhasadka@volcani.agri.gov.il or Prof. Hisayo Yamane, Laboratory of Pomology, Graduate School of Agriculture, Kyoto University, Kyoto 606-8502, Japan. E-mail: yamane.hisayo.6n@kyoto-u.ac.jp or Prof. Dr. Masahiro Kanaoka, Prefectural University of Hiroshima, Nanatsuka5562

Shobara 7270023, Japan. E-mail: mkanaoka@pu-hiroshima.ac.jp
E-mail symposium: p-ihc2026@convention.co.jp
Web: https://www.ihc2026.org/symposia/s27/

- September 25-28, 2026, Antalya (Turkey): **IV International Symposium on Fruit Culture along Silk Road Countries**. Info: Prof. Dr. Sezai Ercisli, Ataturk University Agricultural Faculty, Department of Horticulture, 25240 Erzurum, Turkey. Phone: (90) 442-2312599, Fax: (90) 442 2360958, E-mail: sercisli@gmail.com
- November 18-20, 2026, Kathmandu (Nepal): **V International Orchid Symposium.** Info: Prof. Dr. Bijaya Pant, Central Department of Botany, Tribhuvan University, Kathmandu Nepal, Research Director, Annapurna Research Center, Kathmandu, Nepal. Phone: (977)9801203357, E-mail: b.pant@cdbtu.edu.np E-mail symposium: orchidsymposiumnepal@gmail.com Web: https://www.annapurnaresearch.org/internationa orchidsymposium
- November 18-20, 2026, Bastia, Corsica (France): **V International Symposium on Citrus Biotechnology**. Info: Dr. Francois Luro, AGAP Corse Equipe SEAPAG, station INRAE, 20230 San Giuliano, France. Phone: (33)495595946, E-mail: francois.luro@inrae.fr
- NEW November 23-27, 2026, Montagu, Western Cape (South Africa): **XIII International Workshop on Sap Flow**. Info: Dr. Phumudzo Charle Tharaga, office 1.220 Agriculture Building, University of the Free State, 205 Nelson Mandela Drive, 9300 FS Bloemfontein, South Africa. Phone: (27)514012882, E-mail: tharagac@arc.agric.za or Assoc. Prof. Robert Skelton, 1 Jan Smuts Avenue, Braamfontein, 2000 Gauteng Johannesburg, South Africa. Phone: (27)711109778, E-mail: rob.skelton@wits.ac.za or Mr. Muthianzhele Ravuluma, 20 Lelie st, Idasvallei, 7609 Western Cape, Stellenbosch, South Africa. E-mail: ravulumam@arc.agric.za
- November 24-27, 2026, Udon Thani province (Thailand): **International Symposium on Utilization and Cultivation of Medicinal and Aromatic Plants & VII International Symposium on Plant Genetic Resources and Breeding Research on Medicinal and Aromatic Plants**. Info: Mr. Rapibhat Chandarasrivongs, Department of Agriculture, 50 Phaholyothin Rd., Chatuchak 10900, Thailand. Phone: (66)25790583, E-mail: interudonexpo2026@gmail.com

Year 2027

- NEW January 19-22, 2027, Udon Thani province (Thailand): **IV International Symposium on Tropical and Subtropical Ornamentals**. Info: Mr. Rapibhat Chandarasrivongs, Department of Agriculture, 50 Phaholyothin Rd., Chatuchak 10900, Thailand. Phone: (66)25790583, E-mail: interudonexpo2026@gmail.com Web: https://www.doa.go.th/TSO2027/
- January 31 - February 4, 2027, Ghent (Belgium): **VertiFarm2027: IV International Workshop on Vertical Farming**. Info: Dr. Bruno Gobin, Schaessestraat 18, 9070 Destelbergen, Belgium. Phone: (32)93539480, Fax: (32)3539495, E-mail: bruno.gobin@viaverda.be or Annelies Christiaens, Viaverda vzw, Schaessestraat 18, 9070 Destelbergen, Belgium. E-mail: annelies.christiaens@viaverda.be
- June 6-10, 2027, Wageningen (Netherlands): **GreenSys2027**. Info: Dr. Silke Hemming, Wageningen University & Research, Business Unit Greenhouse Horticulture, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317 4 86921, E-mail: silke.hemming@wur.nl or Prof. Dr. Leo F. M. Marcelis, Wageningen University, Horticulture & Product Physiology, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317485675, E-mail: leo.marcelis@wur.nl or Dr. Ep Heuvelink, Greenhouse Crop Physiology and Modelling, Wageningen University, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317483679, Fax: (31)317484709, E-mail: ep.heuvelink@wur.nl
- June 7-10, 2027, Coimbra (Portugal): **XXVIII International EUCARPIA Symposium Section Ornamentals - From Biology to Bioeconomy**. Info: Prof. Dr. Jorge Canhoto, Department of Life Sciences, University of Coimbra, Calçada Martim de Freitas, 3000-456 Coimbra, Portugal. Phone: (351)917859860, E-mail: jorgecan@ci.uc.pt
- June 14-18, 2027, Alnarp (Sweden): **XVII EUCARPIA Symposium on Fruit Breeding and Genetics**. Info: Assoc. Prof. Larisa Gustavsson, Swedish University of Agricultural Sciences, Department of Plant Breeding, Alnarp, Box 190, 234 22 Lomma, Sweden, Sweden. Phone: (46)402858114, E-mail: larisa.gustavsson@slu.se or Prof. Dr. Henryk Flachowsky, Pillnitzer Platz 3a, 01326 Dresden, Germany. E-mail: henryk.flachowsky@julius-kuehn.de
- June 16-18, 2027, Torino (Italy): **VIII International Chestnut Symposium**. Info: Prof. Dr. Gabriele Loris Beccaro, Università degli Studi di Torino, Dept. Agric., Forestry & Food Sci., Largo Paolo Braccini 2, 10095 Grugliasco, Torino, Italy. Phone: (39)0116708802, Fax: (39)116708658, E-mail: gabriele.beccaro@unito.it or Prof. Roberto Botta, DISAFA - University of Torino, Largo Paolo Braccini 2, 10095 Grugliasco (TO), Italy. Phone: (39)0116708800, Fax: (39)0116708658, E-mail: roberto.botta@unito.it
- NEW July 5-11, 2027, Ft. Collins, CO (United States of America): **XI International Peach Symposium**. Info: Assoc. Prof. Ioannis Minas, Dept of Horticulture & Landscape Architect., 301 University Ave., Fort Collins, Campus Delivery 1173, CO 80523-1173, United States of America. Phone: (+1)9704917216, E-mail: ioannis.minas@colostate.edu
- July 11-16, 2027, Pergine Valsugana (Italy): **XIV International Rubus and Ribes Symposium**. Info: Paolo Zucchi, via albere 14, 38050 Tenna (TN), Italy. E-mail: paolo.zucchi@santorsola.com or Lara Giongo, Fondazione Edmund Mach via E. Mach,1, San Michele aA, Italy. E-mail: laraxgiongo@gmail.com E-mail symposium: ruri@santorsola.com Web: https://ruri.santorsola.com/
- July 19-22, 2027, Chiang Mai (Thailand): **VIII International Symposium on Lychee, Longan and Other Sapindaceae Fruits**. Info: Assoc. Prof. Theeranuch Jaroenkit, Dept. Of Horticulture, Faculty of Agric. Production, Maejo University, San Sai, Chiang Mai 50290, Thailand. Phone: (66)53873605, E-mail: theeranu@gmail.com or Assoc. Prof. Chiti Sritontip, Agricultural Technology Research Institute, 202 Moo 17, Tambon Pichai, Amphur Muang, Lampang, 52000, Thailand. Phone: (66) 54-342553, Fax: (66) 54-342550, E-mail: chiti@rmutl.ac.th
- August 31 - September 3, 2027, Banja Luka (Bosnia and Herzegovina): **VI Balkan Symposium on Fruit Production Systems**. Info: Prof. Dr. Miljan Cvetkovic, Vojislava Djede Kecmanovica 1A, 78000 Banja Luka, Bosnia and Herzegovina. Phone: (387) 51 330 938, E-mail: miljan.cvetkovic@agro.unibl.org or Prof. Dr. Boris Pasalic, Kosovke djevojke 2, 78000 Banjaluka, Bosnia and Herzegovina. E-mail: boris.pasalic@agro.unibl.org
- September 5-9, 2027, Bucharest (Romania): **VIII International Symposium on Fig**. Info: Prof. Dr. Florin Stanica, University of Agronomic Sciences, Faculty of Horticulture, B-dul Marasti, 59, Sector 1, 011464, Bucuresti, Romania. Phone: (40)722641795, Fax: (40)213182888, E-mail: flstanica@yahoo.co.uk E-mail symposium: figsymposium2027@usamv.ro
- September 6-9, 2027, Matera (Italy): **XII International Symposium on Kiwifruit**. Info: Prof. Dr. Bartolomeo Dichio, Università degli Studi della Basilicata, DICEM, Via S.Rocco, 75100 Matera, Italy. Phone: (39)08351971422, E-mail: bartolomeo.dichio@unibas.it or Prof. Cristos Xiloyannis, vico san leonardo,35, DICEM, Via S.Rocco, 75100 Matera, Italy. Phone: (39)0835314347, E-mail: cristosxiloyannis15@gmail.com or Dr. Alba Mininni, Università degli studi della Basilicata, DICEM, via passarelli 113, 75100 Matera (MT), Italy. E-mail: alba.mininni@unibas.it
- September 13-17, 2027, Beijing (China): **XI International**

Symposium on Soil and Substrate Disinfestation. Info: Qiuxia Wang, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, 2 West Yuanmingyuan Road, Haidian District, Beijing, China. E-mail: wqxcasy@163.com E-mail symposium: sd2027@vip.163.com

- September 20-23, 2027, Zaragoza (Spain): **II International Symposium on Nursery Production of Certified Fruit Trees**. Info: Maria Jose Rubio Cabetas, Plant Science, Avda Montañana 930, 50059 Zaragoza, Spain. Phone: (34)976 716300, Fax: (34)976 716335, E-mail: mjrubioc@cita-aragon.es or Ms. Maria Teresa Espiau, CITA, Avda. Montañana, 930, 50059 Zaragoza, Spain. Phone: (34)976716218, Fax: (34)976716335, E-mail: mespiau@cita-aragon.es or Bibiana Macarulla Quintilla, CITA, Avda. Montañana, 930, 50059 Zaragoza, Spain. E-mail: bmacarulla@cita-aragon.es
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- October 4-8, 2027, Palermo (Italy): **X International Olive Symposium**. Info: Prof. Dr. Tiziano Caruso, Department of Agricultural & Forest Science, University of Palermo, Viale delle Scienze, Edificio 4 ingresso H, 90128 Palermo, Italy. Phone: (39) 09123861207, E-mail: tiziano.caruso@unipa.it or Dr. Riccardo Lo Bianco, Università degli Studi di Palermo, Dipartimento SAAF, Viale delle Scienze, Ed 4, 90128 Palermo, Italy. Phone: (39) 09123896097, Fax: (39) 09123860813, E-mail: riccardo.lobianco@unipa.it or Prof. Francesco Marra, Department of Agricultural & Forest Science, Viale delle Scienze, Edificio 4 ingresso H, 90128 Palermo, Italy. Phone: (39)09123861236, Fax: (39)09123861211, E-mail: francescopaolo.marra@unipa.it
- October 17-21, 2027, Nanjing (China): **II International Symposium on Models for Plant Growth, Environments, Farm Management in Orchards and Protected Cultivation - HorchiModel2027**. Info: Prof. Dr. Juyou Wu, Weigang No.1, Nanjing, Jiangsu, 210095, China. E-mail: juyouwu@njau.edu.cn or Assoc. Prof. Ningyi Zhang, Nanjing Agricultural University, 210095, Nanjing, China. E-mail: ningyi.zhang@njau.edu.cn or Prof. Dr. Zhanwu Dai, Haidian, Xiangshan, Nanxincun 20, Beijing, China. E-mail: zhanwu.dai@ibcas.ac.cn

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